

HIP HANDBOOK

Guidance of Programmatic Requirements and Process



Ver5.2



**SECTIONS HIGHLIGHTED IN YELLOW HAVE NOT BEEN APPROVED
BY THE SERVICES**

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Chapter 1 Overview

1.1 HIP Background

The HIP HANDBOOK represents a concise summary of the requirements of two biological opinions (BiOps) issued by the United States Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) on the effects of BPA's Habitat Improvement Program (HIP III) and future versions.

BPA & the Services expects the HIP HANDBOOK to always be a living document with a process available to update and incorporate advances in scientific, engineering, and regulatory fields. Sponsor comments were accepted when previous versions of the Handbook were made public in the summer of 2014, 2015, 2016 & 2017. Comments and changes were reviewed and approved by BPA Technical Services, Environmental Compliance, NMFS & USFWS.

The fish and wildlife habitat improvement projects funded by BPA are the focus of these two BiOps. BPA funds these projects in fulfillment of its obligations under two auspices: The Northwest Power and Conservation Council's (NWPPCC's) Columbia River Basin Fish and Wildlife Program, and the various BiOps issued to BPA including the 2008 BiOp addressing the operation and maintenance of the Federal Columbia River Hydropower System (FCRPS).

With HIP, BPA has engineering technical experts who provide a design review of each medium to high risk project in accordance with design complexity and significance. This is an internal quality assurance/quality control (QA/QC) process at BPA, the role of which is to define high, medium, and low risk project types, and then provide additional review on medium and high risk projects.

For USFWS terrestrial species, species-specific conservation measures may apply. Please contact your Environmental Compliance Lead (EC Lead) for additional requirements.

Link to this document:

www.bpa.gov/goto/ESA

1.2 Instances when the HIP cannot be used.

The three most common instances where the HIP cannot be used.

They include:

- 1) An activity is not described/covered by HIP. For example, flow diversions for ponds or blasting natural fish passage barriers.
- 2) An activity is bigger than the limitations of an existing HIP category. For example, a dam removal that is taller or wider than the HIP requirements.
- 3) An activity contradicts HIP. For example, filling in a wetland or floodplain.
- 4) An activity that may result in exceeding Incidental Take Limitations for fish. For example adult take, excessive juvenile take and destruction of redds.

If at any time there are uncertainties in implementing or interpreting the Conservation Measures listed in this document, the project sponsor, in conjunction with BPA staff, will coordinate with the Services in effort to provide clarity and resolve any outstanding issues.



“Sponsors, and their consultants, should be developing their projects with the HIP handbook by their side. The more effort they put into ensuring their design elements are actions covered under HIP and include the associated conservation measures, the easier/smoothier/faster the HIP Review Process will go for everyone. This means fewer comments from us and less issues to resolve between BPA and anyone else involved with the project.”

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1.3 HIP BO Categories of Action.

Category 1: Fish Passage Restoration (Profile Discontinuities)

- 1a) Dams, Water Control, or Legacy Structure Removal
- 1b) Consolidate or Replace Existing Irrigation Diversions
- 1c) Headcut and Grade Stabilization
- 1d) Low Flow Consolidation
- 1e) Providing Fish Passage at an Existing Facility

Category 1: Fish Passage Restoration (Transportation Infrastructure)

- 1f) Bridge and Culvert Removal or Replacement
- 1g) Bridge and Culvert Maintenance
- 1h) Installation of Fords

Category 2: River, Stream, Floodplain, and Wetland Restoration

- 2a) Improve Secondary Channel and Floodplain Interactions
- 2b) Set-back or Removal of Existing, Berms, Dikes, and Levees
- 2c) Protect Streambanks Using Bioengineering Methods
- 2d) Install Habitat-Forming Instream Structures (Large Wood, Small Wood & Boulders)
- 2e) Riparian Vegetation Planting
- 2f) Channel Reconstruction

2g) Install Habitat-Forming Materials (Sediment and Gravel)

Category 3: Invasive Plant Control

- 3a) Manage Vegetation using Physical Controls
- 3b) Manage Vegetation using Herbicides (Riverine)
- 3c) Manage Vegetation using Herbicides (Estuarine)
- 3d) Juniper Removal
- 3e) Prescribed Burning

Category 4: Piling Removal

Category 5: Road and Trail Erosion Control, Maintenance, and Decommissioning

- 5a) Maintain Roads
- 5b) Decommission Roads

Category 6: In-Channel Nutrient Enhancement

Category 7: Irrigation and Water Delivery/Management Actions

- 7a) Convert Delivery System to Drip or Sprinkler Irrigation
- 7b) Convert Water Conveyance from Open Ditch to Pipeline or Line Leaking Ditches or Canals
- 7c) Convert from Instream Diversions to Groundwater Wells for Primary Water Sources
- 7d) Install or Replace Return Flow Cooling Systems
- 7e) Install Irrigation Water Siphon Beneath Waterway
- 7f) Livestock Watering Facilities
- 7g) Install New or Upgrade/Maintain Existing Fish Screens

Category 8: Fisheries, Hydrologic, and Geomorphologic Surveys

Category 9: Special Actions (for Terrestrial Species)

- 9a) Install/Develop Wildlife Structures
- 9b) Fencing construction for Livestock Control
- 9c) Implement Erosion Control Practices
- 9d) Plant Vegetation
- 9e) Tree Removal for Large Wood Projects
- 9f) Willamette Valley Prairie Restoration Actions

1.4 Work Element by HIP Risk Category.

ID	Work Element Name	Definition	HIP Category	HIP Review	Risk Level
29	Increase Aquatic and/or Floodplain Complexity	Work that adds natural materials instream to create habitat features or to improve channel morphology. Also includes improving complexity by creation of pools or fish spawning habitat by addition of gravel. This work element should not be used for bank stabilization unless it is part of a larger habitat or complexity action.	1c, 2c, 2d, 2f, 2g	✓	low, med, high
30	Realign, Connect, and/or Create Channel	Active attempts to directly add sinuosity, meanders, side channels, and/or off-channel habitats (e.g., sloughs or oxbows). May include reconnection of historical channels (either via excavation or diversion of existing streamflow), excavation of new channels, and/or significantly improving the functionality of existing channels (e.g., creating a "natural" spawning channel for chum).	2d, 2f	✓	med-high
33	Decommission Road/Relocate Road	Any activity that makes a road or trail unusable including adding berms, pits, boulders or logs, and/or ripping, scarifying, recontouring, or obliterating the road or trail with heavy equipment that may involve re-contouring the slope. Also use for building a road or trail in a more appropriate location to replace a decommissioned road or trail.	5a, 5b		low
34	Develop Alternative Water Source	Provision of water supply for livestock that is out of the water zone and at a distance beyond that which may affect the conditions of the water body. Includes, but not limited to, watering troughs, spring and well development, and guzzler installation.	7f		low
35	Develop Pond	Develop a pond and its surrounding habitat for resident fish and/or waterfowl. May involve the installation of a water control structure or excavation. Does not apply to sediment control ponds	2a, 9a	✓	med
36	Develop Terrestrial Habitat Features	Includes the installation and/or creation of structures for the benefit of wildlife species, including, but not limited to, nest boxes/platforms, avian perches, snags, guzzlers, and artificial roosting sites.	9a, 9f		low
38	Improve Road for Instream Habitat Benefits	Work designed to eliminate or reduce erosion, sediment, and/or toxic run-off from reaching streams, rivers, or wetlands from roads or trails currently in use. This includes road projects that reduce or eliminate inter-basin transfer of water, placement of structures to contain/ control run-off from roads or trails, road or trail reconstruction or reinforcement, surface and peak-flow drainage improvements, and roadside vegetation.	5a		low
40	Install Fence	Work to install various types of fence and/or gates for habitat improvement. If applicable, include cattle guards or water gaps for livestock as part of the deliverable. For riparian fencing, BPA recommends project sponsors include 50+ foot riparian buffers, or wider, based on the stream type, site specific dynamics, and current research. This work is not generally intended to be used for upland fencing for pasture rotation purposes.	9b		low
44	Enhance Nutrients in Water Bodies	Addition of fish carcasses, or direct nutrient introduction methods to improve biological diversity in streams, rivers, or lakes.	6		low

47	Plant Vegetation	Use during the first year (and only first year) of planting terrestrial or aquatic vegetation and/or seed (aerially, mechanically, and/or manually). Use for wildlife cover and forage enhancement, erosion control and soil stabilization, roughness recruitment, shading, restoring native habitat, wildfire restoration, and rehabilitating removed roads/trails.	2e, 9d		low
55	Erosion and Sedimentation Control	This is work that occurs in the riparian and upland zones, which may include the installation of water bars, gully plugs and culvert outlets, grassed waterways, grade stabilization structures, sediment catchment ponds/basins, regrading or terracing, and removal of drainage pipes and other blockages specifically to prevent erosion, sediment slumps, or landslides.	9c		low
69	Install Fish Screen	Work to install or replace a fish screen associated with a diversion or pump. Typical screen types include rotary drum, flat plate or traveling.	7g		low-med
80	Install Siphon	Covers work that installs a siphon, flume, or other structure to separate canal flow from stream flow where the two have been intermingled as part of past water diversion development, resulting in fish using the natural stream course for passage and rearing.	7e	✓	low
84	Remove/Install Diversion	Work that removes, replaces, or avoids creating a fish passage barrier associated with a stream diversion, including push-up dams. May be part of a diversion consolidation effort that reduces the number of diversion sites.	1a, 1b	✓	med-high
85	Remove/Breach Fish Passage Barrier	Work that facilitates fish passage over a human-made barrier by breaching or removal without replacement. This includes dams, weirs, fish ladders, tidegates, culverts, bridges, and road crossings.	1a	✓	med-high
148	Install Flow Measuring Device	Includes activities for installing and/or moving electrical flow gauges or other complex flow measuring devices, such as flow gauges using telemetry to transmit data. Devices may be fixed or portable, and tend to be left in place for a full season or longer.	7g		low
180	Enhance Floodplain/Remove, Modify, Breach Dike	Refers to the removal, breaching, or alteration/set-back of a dike to restore riparian/floodplain or wetland habitat. This may also involve the installation of a tidegate or culvert. Also includes re-contouring of habitat to restore or enhance wetland or floodplain functionality and connectivity.	2a, 2b	✓	med-high
181	Create, Restore, and/or Enhance Wetland	Refers to the creation, restoration, or enhancement of a wetland area or function. This may be from the installation of a water control structure, re-contouring, and excavation to improve habitat connectivity.	2a	✓	med-high
184	Install Fish Passage Structure	Install, replace, or modify structures when the intent is to improve fish passage and/or flow, typically by removing or modifying a full or partial instream barrier. "Structures" include: fish ladders, bridges, culverts, jump pools, roughened channels, and weirs. "Barriers" include such obstacles to fish passage as man-made dams (including push-up diversion dams), tidegates, weirs, culverts, rock fords and road crossings, as well as natural barriers such as logjams and natural streambeds.	1e, 1f	✓	med

198	Maintain Vegetation	Maintain planted or pre-existing vegetation through physical, chemical, mechanical, and/or biological activities such as scalping, installing mats or mulch, mowing, irrigating, fertilizing, applying herbicide(s), burning, using Integrated Pest Management (IPM), preventing or reducing animal damage (browse repellents, tree tubes).	3a, 3b, 3c, 3d	low
199	Remove Vegetation	Use during the initial year of treating a site if removing one or more plant species, or a number of individuals of a plant species, by mechanical, biological, and/or chemical means, or by controlled burn.	3a, 3b, 3c, 3d	low
203	Install Water Conservation Measure	This work element is for work designed to provide irrigation efficiencies which result in increased instream flow, such as installing a pipeline, sprinkler, and/or lining a diversion ditch. Other options should have already been considered to accomplish this purpose, such as water transactions or obtaining cost-share for this work element and subsequently transferring conserved water instream.	7a, 7b, 7c	low



1.5 ESA-Listed Species Covered Under HIP.

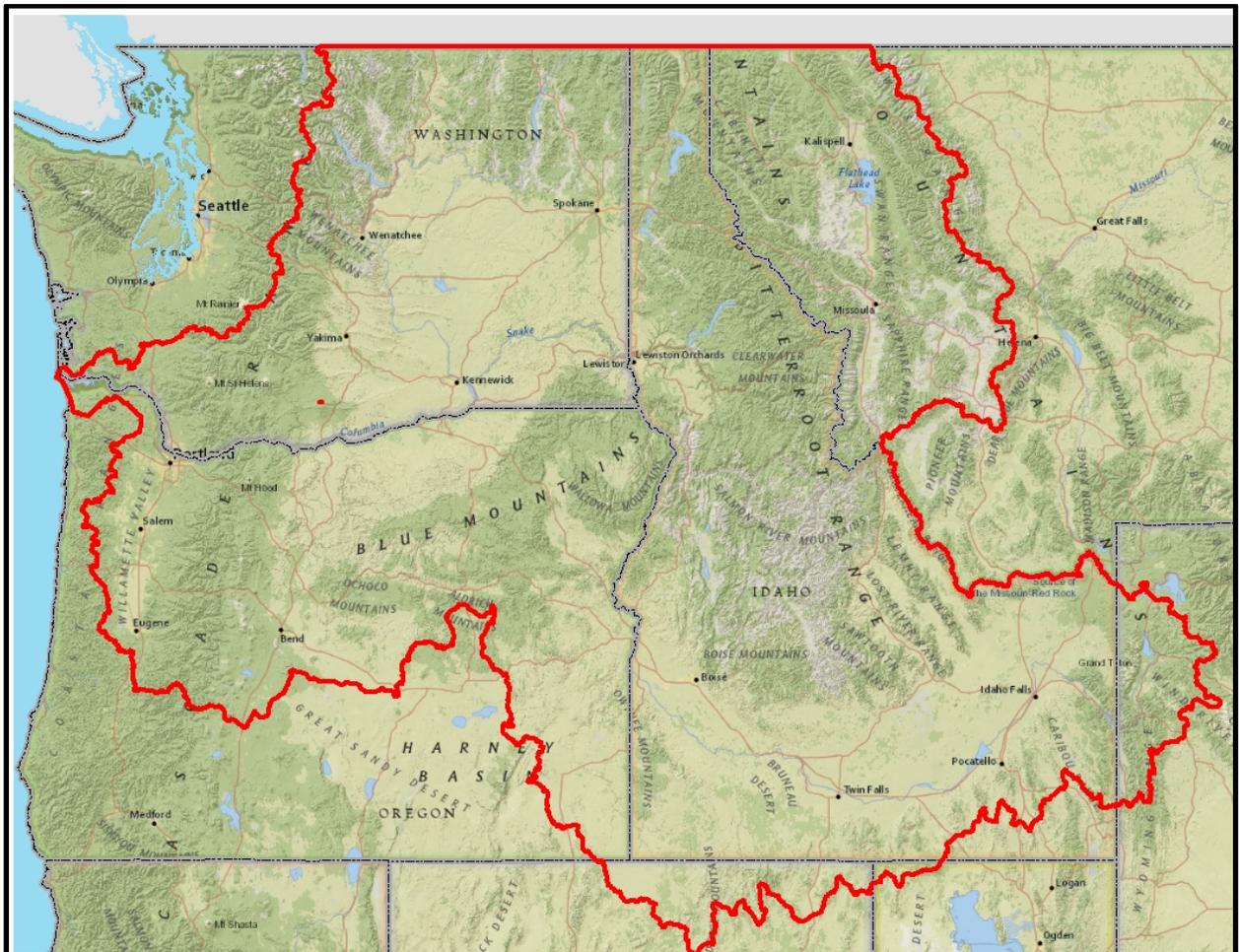
ANADROMOUS SALMONIDS (by Evolutionarily Significant Units)	
Lower Columbia River Chinook salmon	<i>Oncorhynchus tshawytscha</i>
Upper Willamette River spring-run Chinook salmon	<i>O. tshawytscha</i>
Upper Columbia River spring-run Chinook salmon	<i>O. tshawytscha</i>
Snake River spring/summer-run Chinook salmon	<i>O. tshawytscha</i>
Snake River fall-run Chinook salmon	<i>O. tshawytscha</i>
Columbia River chum salmon	<i>O. keta</i>
Lower Columbia River coho salmon	<i>O. kisutch</i>
Oregon Coast coho salmon	<i>O. kisutch</i>
Snake River sockeye salmon	<i>O. nerka</i>
Lower Columbia River steelhead	<i>O. mykiss</i>
Upper Willamette River steelhead	<i>O. mykiss</i>
Middle Columbia River steelhead	<i>O. mykiss</i>
Upper Columbia River steelhead	<i>O. mykiss</i>
Snake River Basin steelhead	<i>O. mykiss</i>
ANADROMOUS FISHERIES	
Pacific eulachon, southern DPS	<i>Thaleichthys pacificus</i>
Green sturgeon, southern DPS	<i>Acipenser medirostris</i>
FRESHWATER FISH	
Bull Trout	<i>Salvelinus confluentus</i>
AMPHIBIANS	
Oregon Spotted Frog	<i>Rana pretiosa</i>
MAMMALS	
Canada lynx, contiguous U.S. DPS	<i>Lynx canadensis</i>
Columbian white-tailed deer	<i>Odocoileus virginianus leucurus</i>
Gray wolf	<i>Canis lupus</i>
Grizzly bear	<i>Ursus arctos horribilis</i>
North American wolverine	<i>Gulo gulo luscus</i>
Northern Idaho ground squirrel	<i>Urocitellus brunneus</i>
Pygmy rabbit	<i>Brachylagus idahoensis</i>
Woodland caribou – Selkirk Mountain	<i>Rangifer tarandus caribou</i>
BIRDS	
Marbled murrelet	<i>Brachyramphus marmoratus</i>
Northern spotted owl	<i>Strix occidentalis caurina</i>
Streaked horned lark	<i>Eremophila alpestris strigata</i>
Yellow Billed Cuckoo	<i>Coccyzus americanus</i>
INVERTEBRATES	
Bliss Rapids snail	<i>Taylorconcha serpenticola</i>
Snake River Physa snail	<i>Physa natricina</i>
Fender's blue butterfly	<i>Icaricia icarioides fenderi</i>
Taylor's Checkerspot butterfly	<i>Euphydryas editha taylori</i>
PLANTS	
Bradshaw's desert-parsley	<i>Lomatium bradshawii</i>

Golden paintbrush	<i>Castilleja levisecta</i>
Howell's spectacular thelypody	<i>Thelypodium howellii spectabilis</i>
Kincaid's lupine	<i>Lupinus sulphureus ssp. kincaidii</i>
McFarlane's four-o'clock	<i>Mirabilis macfarlanei</i>
Nelson's checkermallow	<i>Sidalcea nelsoniana</i>
Slickspot peppergrass	<i>Lepidium papilliferum</i>
Spalding's catchfly	<i>Silene spaldingii</i>
Ute ladies'-tresses	<i>Spiranthes diluvialis</i>
Water howellia	<i>Howellia aquatilis</i>
Wenatchee Mountains checkermallow	<i>Sidalcea oregana var. calva</i>
Willamette daisy	<i>Erigeron decumbens</i>



1.6 Action Area.

The action area for the HIP consists of the Columbia River Basin in Oregon, Washington, and Idaho. The action area includes western Montana and Oregon coastal river basins from the Columbia River Estuary. The action area was expanded to reflect additional BPA projects, anticipated to be covered under the HIP, in these geographic areas.



Chapter 2 Process

2.1 The HIP Review Process.

PART 1: RISK DETERMINATION

START

- 1) **Sponsor** provides conceptual designs (typically 15%) to **EC Lead**
- 2) **EC Lead** makes initial **Risk Determination**
 - i) If **Low Risk**
 - (1) The **EC Lead** provides to **Sponsor**
 - (a) Conservation Measures Checklist or CAD file
 - (b) HIP Project Notification Form (PNF)
 - (2) The EC Lead submits completed PNF to HIP Reporting
 - ii) If **Med/High Risk**
 - (1) the **EC Lead** provides to **Sponsor**:
 - (a) Conservation Measures Checklist or CAD file
 - (b) Basis of Design Report (BDR) Requirements
 - (2) The **EC lead** initiates **HIP Review Process**
 - (a) Follow Parts 2 through 4 below

NOTE: Med/High Risk projects should be considered anything that changes the hydraulic character of river

PART 2: INITIATION OF HIP REVIEW PROCESS (Med & High Risk)

- 1) **EC Lead**
 - a) Create Project Folder
W:\EC\HIP\HIP_REVIEW\PROJECTS
 - b) Navigate to Project Folder > Utilize Habitat Area Map  to determine Project Location > Choose corresponding folder to create your project folder.
 - c) Use the following file naming convention.

2019(Gambetta)Smash_Creek

Current year EC Lead Project Name
 - d) Places designs and documentation to project folder
 - e) Starts **HIP Comment Tracking Form** and place in project folder



- f) Submits **ETS SUPPORT REQUEST** via Email.

----Email Request Template----

To: FW-ETS@bpa.gov
Cc: HIP_Reporting@bpa.gov, **COTR**

Subject: HIP technical review request – **Project Name**

The <**Insert Project Name**> project requires a technical review per HIP 4 requirements. Please respond to this email once an ETS member has been assigned as the HIP tech lead. A HIP folder has been created <**provide link here**>. The folder contains all available design materials and a comment tracking form filled out with all available background information.

- g) Schedules internal meeting (if necessary)
h) Solicits Interagency Participation (for **High** risk projects)
i) Schedules site visit (if necessary)
- 2) **ETS Tech Lead**
- a) Verifies project information
b) Creates internal ETS Record
c) Assigns **Technical Lead**
d) Sends out notification email to **EC Lead**, and **COTR**
e) Verifies Risk Level
f) Attends site visit
g) Determines Review schedule (how many review junctures)

PART 3: TECHNICAL AND FUNCTIONAL REVIEWS

- 1) **Tech Lead**
- a) Conducts technical review at specified review junctures, typically 15%, 30%, and 80% (Refer to technical and functional review junctures, Section 2.3)
b) Provides comments to EC Lead via **HIP Comment Tracking Form**.
- 2) **EC Lead**
- a) Compiles comments from interagency partners (high risk)
b) Conducts functional review (HIP requirements)
c) Provides comments to **Sponsor** via:
High/Med Risk Comment Email
d) Reviews **Sponsor**'s response to comments with **Tech Lead**.
e) Sets up review meeting with reviewers and **Sponsor** if needed.
f) Instructs sponsor to proceed to next review milestone once comments closed.
g) Solicits **NMFS Engineering** approval.
- 3) **Sponsor**

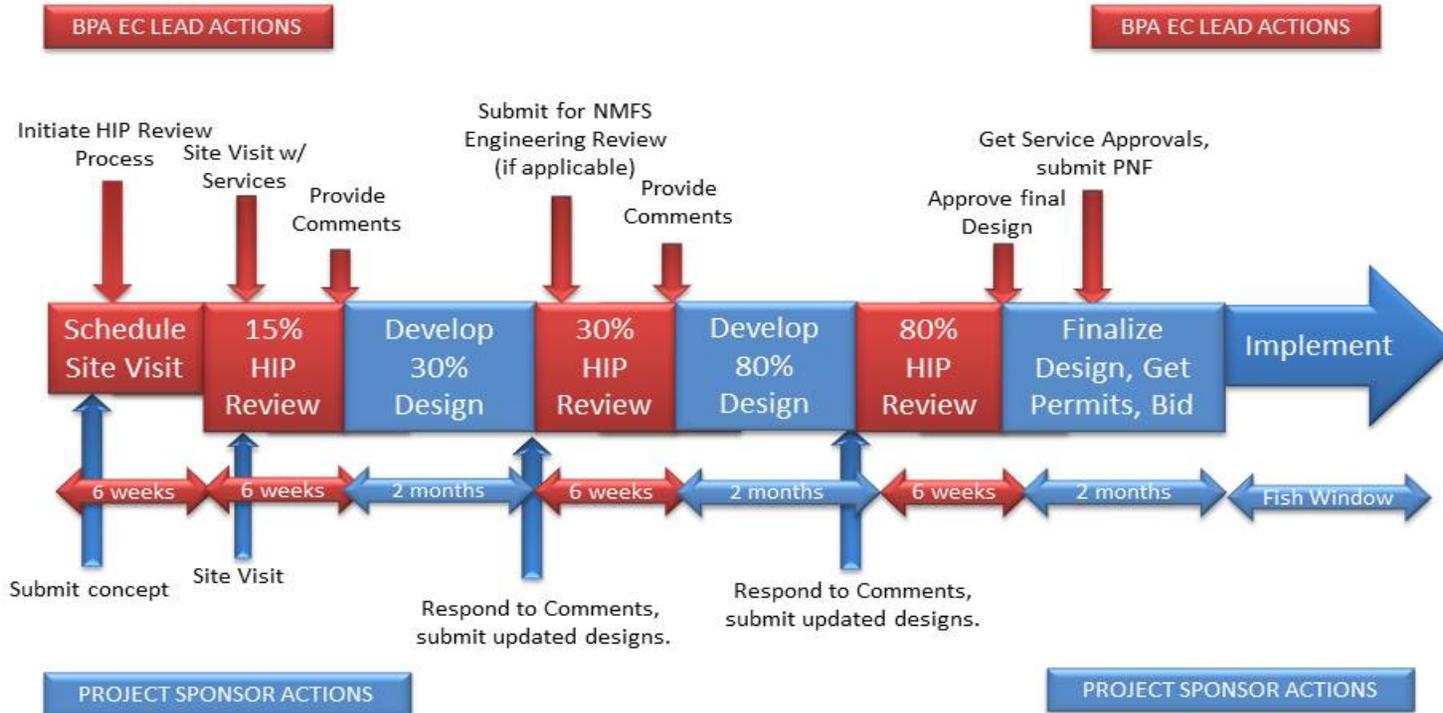
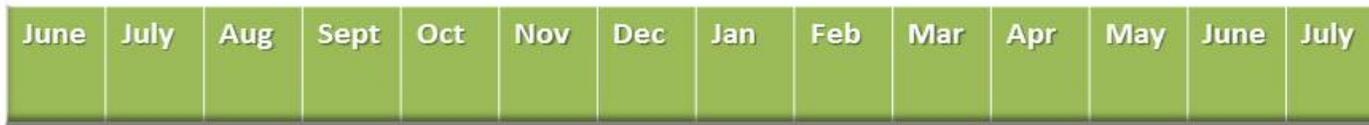
- a) Provides response to comments.
- b) Updates BDR and plans as appropriate once EC Lead gives notice to proceed.
- 4) **Program Lead**
 - a) Provides support
 - b) Documents process
 - c) Arbitrates disagreements

PART 4: CONCLUSION

- 1) **Sponsor**
 - Provides final designs and responses to **HIP Comment Tracking Form**
- 2) **Tech Lead**
 - Approves design
- 3) **EC Lead**
 - a) If **Med Risk EC Lead** sends approval email to **Sponsor**
 - b) If **High Risk EC Lead** solicits final approval from **NMFS** branch chief and/or **USFWS** field office supervisor
 - c) Saves emails and approvals in Project folder
 - d) Submits final PNF to HIP Reporting
- 4) **Program Lead**
 - a) Documents conclusion
 - b) Verifies project folder contains reviews and emails
 - c) QA/QC PNF
 - d) Submits PNF to Services



FINISH



Timeframes are estimates. Design review stages may be modified based on complexity and contracted design iterations.

2.2 HIP Review High Risk Timeline.

2.3 Technical and Functional Review Junctures.

The following project review junctures are proposed as standard project quality assurance junctures for high risk projects and may be used for medium risk projects based on the scope and complexity of the project. The number of review junctures depends on the adequacy of information provided, incorporation of comments recommendations, and may be modified to align with identified project junctures.

Conceptual Project Review (typically 15%): The project sponsor will notify BPA at 15% or project concept stage and help the EC Lead coordinate a site visit to review project concepts, goals, and objectives and confirm the direction and planning for subsequent phases of project design. Staff biologists from the NMFS and USFWS shall be invited to the site visit. A typical site visit will include the review of limiting factors and any pertinent studies or reports that document restoration targets for implementation and draft project concepts. Additional data that may be presented and reviewed include other data sources (e.g., high resolution aerial photography, topographic maps, soil maps, GIS/CAD data layers, or other resource data). After the site visit, BPA will collate and provide comments from BPA engineering and interagency partners. Once comments are resolved, the EC Lead will notify the sponsor to proceed with the next design iteration.

Initial Review of Plans and BDR (typically 30%): Preliminary drawings, specifications, a draft Basis of Design Report, and other supporting documentation (profiles, details, cross sections, quantities, technical analyses/appendixes, etc.) for the preferred project alternative will be submitted for review. The 30% design should demonstrate incorporation of technical comments and recommendations from the previous review and shall address the design requirements outlined in Section 2.5. A BDR template addressing the HIP requirements can be provided upon request. In addition to BPA technical and functional reviews, NMFS may require a separate Engineering Review (see Section 2.6). The EC Lead will collate comments from reviewers and interagency partners, and submit them to the sponsor. The EC Lead will notify the Sponsor to proceed to the 80% design plans once 30% comments are resolved.

Final Project Review (typically 80%): The 80% project drawings will be submitted to the EC Lead. Technical, functional, and interagency reviews will take place. The 80% design should demonstrate complete incorporation of technical comments and recommendations developed at the previous design review. The 80% design submittals should include near-final drawings and specifications, including specific site locations, site plans, profiles, cross sections, details, construction quantities, implementation resource plans, and design technical analyses as summarized in a Basis of Design Report. If HIP requirements are not met, additional review iterations may be necessary. Once the EC Lead and Tech Lead have approved the final design, the EC Lead will proceed with final agency approval and notifications.

2.4 Risk Determination

Risk for the purposes of the HIP is defined primarily as risk to ESA-listed species and their habitats; however, risk may be applied to include, though not limited to:

- 1) Precedent- and/or policy-setting actions (e.g., application of new technology);
- 2) Actions that are not necessarily new but are new to a geographic area or stakeholder group;
- 3) Actions with which the project manager, sponsor, or EC Lead is unfamiliar, regardless of the relative risk; and
- 4) Actions that are considered large in complexity and scope or represent a significant investment in BPA resources.

Risk is determined by the EC lead with advice and recommendations from BPA engineering. The risk level is either Low, Medium or High. HIP Review process occurs only on Medium or High Risk Projects.



2.5 Basis of Design Report (BDR) Requirements

The BDR requirements serve as the design submittal framework that is needed to assess and evaluate the adequacy of the proposed project. Planning and design documentation of conservation practices should effectively communicate that appropriate planning, analysis, design and resulting construction documentation are met.

For medium and high risk projects, Basis of Design Report (BDR) shall be included as part of any engineering design contract. It is not an additional or separate action. Monitoring and Adaptive Management Plans, however, can be a separate, additional item, but should not be very expensive because templates are available and most of the info is copied directly out of the design report.

The BPA Tech Lead and EC Lead will review the submitted BDR to determine if the technical deliverables provided are:

- 1) Adequate for functionality (adherence to HIP Conservation Measures).
- 2) Adequate for technical quality (competent execution of design and project plans – contract documents).

A BDR template is available that addresses the requirements below.

Project Background.

- 1) Name and titles of sponsor, firms and individuals responsible for design.
- 2) List of project elements that have been designed by a licensed Professional Engineer.
- 3) Explanation and background on fisheries use (by life stage - period) and limiting factors addressed by project.
- 4) List of primary project features including constructed or natural elements.
- 5) Description of performance / sustainability criteria for project elements and assessment of risk of failure to perform, risk to infrastructure, potential consequences and compensating analysis to reduce uncertainty.
- 6) Description of disturbance including timing and areal extent and potential impacts associated with implementation of each element.

Resource Inventory and Evaluation.

- 1) Description of past and present impacts on channel, riparian and floodplain conditions.
- 2) Instream flow management and constraints in the project reach.
- 3) Description of existing geomorphic conditions and constraints on physical processes.
- 4) Description of existing riparian condition and historical riparian impacts.
- 5) Description of lateral connectivity to floodplain and historical floodplain impacts.
- 6) Tidal influence in project reach and influence of structural controls (dikes or gates).

Technical Data.

- 1) Incorporation of HIP specific Activity Conservation Measures for all included project elements.
- 2) Summary of site information and measurements (survey, bed material, etc.) used to support assessment and design.
- 3) Summary of hydrologic analyses conducted, including data sources and period of record including a list of design discharge (Q) and return interval (RI) for each design element.
- 4) Summary of sediment supply and transport analyses conducted, including data sources including sediment size gradation used in streambed design.
- 5) Summary of hydraulic modeling or analyses conducted and outcomes – implications relative to proposed design.
- 6) Stability analyses and computations for project elements, and comprehensive project plan.
- 7) Description of how preceding technical analysis has been incorporated into and integrated with the construction – contract documentation.
- 8) For projects that address profile discontinuities (grade stabilization, small dam and structure removals): A longitudinal profile of the stream channel thalweg for 10 channel widths upstream and 10 channel widths downstream of the structure shall be used to determine the potential for channel degradation.
- 9) For projects that address profile discontinuities (grade stabilization, small dam and structure removals): 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 area outside of the influence of the structure) to characterize the channel morphology and quantify the stored sediment.

Construction – Contract Documentation.

- 1) Incorporation of HIP General and Construction Conservation Measures
- 2) Design – construction plan set including but not limited to plan, profile, section and detail sheets that identify all project elements and construction activities of sufficient detail to govern competent execution of project bidding and implementation.
- 3) List of all proposed project materials and quantities.
- 4) Description of best management practices that will be implemented and implementation resource plans including:
 - a) Site Access Staging and Sequencing Plan with description
 - b) Work Area Isolation and Dewatering Plan with description of how aquatic organisms within the action area will be treated / protected.
 - c) Erosion and Pollution Control Plan.
 - d) Site Reclamation and Restoration Plan
 - e) List proposed equipment and fuels management plan.
- 5) Calendar schedule for construction/implementation procedures.
- 6) Site or project specific monitoring to support pollution prevention and/or abatement.

Adaptive Management Plans

An adaptive management plan shall be required for certain projects, as discussed under the Activity-Specific Conservation Measures and negotiated throughout the HIP Review Process. Experimental projects may have additional requirements. The Adaptive Management Plan does not constitute specific Research Monitoring and Evaluation (RM&E) related to action effectiveness monitoring of habitat improvement actions. BPA requires that habitat action effective monitoring be described in a separate monitoring plan.

The intent of the Adaptive Management Plan requirement is to provide a structured assessment methodology to support adaptive management decision making if unforeseen conditions occur.

- 1) Introduction
- 2) Responsible parties involved
- 3) Assessment Protocols
- 4) Adaptive Management Triggers
- 5) Assessment Frequency, Timing, and Duration
 - a) Baseline Preproject Survey (generated as part of design contract)
 - b) As-built Survey (How are site conditions post flood differ from pre project conditions.)
 - c) Site Layout Photo Documentation and Visual Inspection
 - d) Fish Passage Qualitative Narrative
- 6) Data Storage and Analysis
- 7) Quality Assurance Plan



2.6 The NMFS Engineering Review Requirement.

NMFS Northwest Region Environmental Services Division (NMFS Engineering) shall conduct reviews on fish passage for the following activity categories and conditions. Fish passage review is initiated by the EC Lead typically at the 30% design review juncture.

1. Fish Passage Restoration:

Profile Discontinuities Category:

a. Dams, Water Control or Legacy Structure Removal.*

YES, small dams with a maximum total head measurement greater than 3 feet, channel spanning weirs, earthen embankments and spillway systems.

b. Consolidate, or Replace Existing Irrigation Diversions.*

YES, irrigation diversion structures greater than 3 feet in height that are to be removed or replaced.

c. Headcut and Grade Stabilization.*

YES, installation of boulder weirs, roughened channels and grade control structures that are above 18 inches in height.

d. Low Flow Consolidation.

YES, all projects with that as the primary intent and using artificial means.

e. Providing Fish Passage at an Existing Facility.

YES, fish Passage improvements at an existing facility that are not upkeep and maintenance such as re-engineering improperly designed fish passage or fish collection facilities, installation of a fish ladder at an existing facility, or other activities that are not upkeep or maintenance.

Transportation Infrastructure:

f. Bridge and Culvert Removal or Replacement.*

NO Hydro Review Required (unless there deviation from criteria (variance)).

g. Bridge and Culvert Maintenance.

NO Hydro Review Required

h. Installation of Fords.

NO Hydro Review Required

2. River, Stream, Floodplain, and Wetland Restoration.

a. Improve Secondary Channel and Wetland Habitats.

NO Hydro Review Required

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

NO Hydro Review Required

c. Protect Streambanks Using Bioengineering Methods.

NO Hydro Review Required.

d. Install Habitat-Forming Natural Material Instream Structures (Large Wood, Boulders, and Spawning Gravel).

NO Hydro Review Required

e. Riparian Vegetation Planting.

NO Hydro Review Required

f. Channel Reconstruction.

NO, Hydro Review Required (unless there is a fish passage component.)

g. Beaver Dam Analogues

NO Hydro Review Required, NMFS Habitat Biologist Review Required.

******In addition, any fish screen with pumping rate that may exceed 3cfs.***

2.7 HIP Forms – Project Notification Form (PNF).

B O N N E V I L L E P O W E R A D M I N I S T R A T I O N

**HIP III PROGRAMMATIC - CONSULTATION
PROJECT NOTIFICATION FORM**

HIP III No:

Lead Action Agency: BPA			
NMFS Tracking #: 2013/9724	Statutory Authority: <input type="checkbox"/> ESA & EFH <input type="checkbox"/> ESA	USFWS Tracking #: 01EOFW00-2013-F-0199	
Date of Request:	DATE		
Project Title:	Click here to enter text.		
BPA Project #:	Click here to enter text.	Contract #:	Click here to enter text.
BPA EC Contact:	Click here to enter text.	Phone:	Click here to enter text.
Project Sponsor Contact:	Click here to enter text.	Phone:	Click here to enter text.
Project Affiliation:	Click here to enter text.		
NMFS Branch Office:	Choose a NMFS Branch Office		
USFWS Field Office:	Choose a USFWS Field Office		
Lat/Long: (in decimal degrees, WGS84)	Click here to enter text.	County:	Choose a County.
6 th Field HUC:	Click here to enter text.	HUC Name:	Click here to enter text.

Project Start Date:	DATE	Project End Date:	DATE	Completed Form Due Date:	DATE
---------------------	------	-------------------	------	--------------------------	------

(Project Completion Form and/or Herbicide Use Form due ≤60-days after Project End Date)

Does the project consist of Invasive Plant Control only?	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Does the project require work area isolation/fish salvage?	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Does the project require a variance?	Yes <input type="checkbox"/>	No <input type="checkbox"/>

Project Description
List the project activities and describe the intended result(s); tell when the project is to occur; describe how the activities will be implemented; provide any other pertinent information. Please include Work Element for each activity.

Click here to enter text.

Please refer to HIP No# when discussing project.

Note Project Completion Form (PCF) Due Date

If Invasive Plants only no need for PCF

Simple Description:
“Adding 40 pieces of large wood to RM 3.”

Variance Request

Describe how the effects of the requested variance fall within the range of effects described for the proposed activities in the HIP III Opinion, by addressing the following:

- 1) Define the requested variance and the relevant criterion by page number.
Click here to enter text.
- 2) Environmental conditions anticipated at the time of the proposed work (flow and weather conditions).
Click here to enter text.
- 3) Biological justification as to why a variance is necessary and a brief rationale why the variance will either provide a conservation benefit or, at a minimum, not cause additional adverse effects beyond the scope of the Opinion.
Click here to enter text.
- 4) Include as attachments any necessary approvals from state agencies.
Click here to enter text.

NMFS Species/Critical Habitat Present in Action Area:

Anadromous Fish:

- | | |
|--|--|
| <input type="checkbox"/> Lower Columbia River Chinook | <input type="checkbox"/> Upper Willamette River Chinook |
| <input type="checkbox"/> Lower Columbia River coho | <input type="checkbox"/> Upper Willamette River steelhead |
| <input type="checkbox"/> Lower Columbia River steelhead | <input type="checkbox"/> Snake River spring/summer-run Chinook |
| <input type="checkbox"/> Middle Columbia River steelhead | <input type="checkbox"/> Snake River fall-run Chinook |
| <input type="checkbox"/> Upper Columbia River spring-run Chinook | <input type="checkbox"/> Snake River Basin steelhead |
| <input type="checkbox"/> Upper Columbia River steelhead | <input type="checkbox"/> Snake River sockeye |
| <input type="checkbox"/> Columbia River chum | <input type="checkbox"/> Pacific eulachon |
| <input type="checkbox"/> Green sturgeon | |

Essential Fish Habitat Species:

- | | |
|---|--|
| <input type="checkbox"/> Salmon (West Coast Salmon FMP) | <input type="checkbox"/> Estuarine Composite (Ground fish, pelagics) |
|---|--|

USFWS Species/Critical Habitat Present in Action Area:

Freshwater Fish Species:

- Bull Trout

Mammalian Species:

- | | |
|--|--|
| <input type="checkbox"/> Canada lynx* | <input type="checkbox"/> North American wolverine |
| <input type="checkbox"/> Columbia white-tailed deer* | <input type="checkbox"/> Pygmy rabbit* |
| <input type="checkbox"/> Gray wolf* | <input type="checkbox"/> Northern Idaho ground squirrel* |
| <input type="checkbox"/> Grizzly bear* | <input type="checkbox"/> Woodland caribou* |

Avian Species:

- | | |
|---|--|
| <input type="checkbox"/> Marbled murrelet | <input type="checkbox"/> Streaked horned lark* |
| <input type="checkbox"/> Northern spotted owl | <input type="checkbox"/> Western snowy plover |

Invertebrate Species:

- | | |
|---|---|
| <input type="checkbox"/> Banbury Springs limpet | <input type="checkbox"/> Taylor's checkerspot butterfly |
| <input type="checkbox"/> Bliss Rapids snail* | <input type="checkbox"/> Snake River physa snail* |
| <input type="checkbox"/> Bruneau Hot springs snail* | <input type="checkbox"/> Oregon silverspot butterfly |
| <input type="checkbox"/> Fender's blue butterfly | |

This is where Variance information gets communicated to Services

Species Affected

Species
Affected
Continued

Plant Species:

- Bradshaw's lomatium
- Cook's lomatium
- Gentner's fritillary
- Golden paintbrush
- Howell's spectacular thelypody
- Kincaid's lupine
- Large-flowered wooly meadowfoam
- Malheur wire-lettuce
- McFarlane's four o'clock
- Nelson's checkermallow
- Rough popcorn flower
- Showy stickseed
- Slickspot peppergrass
- Spalding's catchfly
- Umtanum Desert buckwheat
- Ute ladies' tresses
- Water howellia
- Wenatchee Mountain checkermallow
- Western lily
- White Bluffs bladderpod
- Willamette daisy

Types of Action:

Identify the types of action(s) proposed.

1. Fish Passage Restoration (Profile Discontinuities)

- a. Dams, Water Control or Legacy Structure Removal
- b. Consolidate, or Replace Existing Irrigation Diversions
- c. Headcut and Grade Stabilization
- d. Low Flow Consolidation
- e. Providing Fish Passage at an Existing Facility

Fish Passage Restoration (Transportation Infrastructure)

- f. Bridge and Culvert Removal or Replacement
- g. Bridge and Culvert Maintenance
- h. Installation of Fords

2. River, Stream, Floodplain, and Wetland Restoration

- a. Improve Secondary Channel and Wetland Habitats
- b. Set-back or Removal of Existing Berms, Dikes, and Levees
- c. Protect Streambanks Using Bioengineering Methods
- d. Install Habitat-Forming Natural Material Instream Structures (Large Wood, Boulders, and Spawning Gravel)
- e. Riparian Vegetation Planting
- f. Channel Reconstruction*

3. Invasive and Non-Native Plant Control

- a. Manage Vegetation using Physical Controls
- b. Manage Vegetation using Herbicides

4. Piling Removal.

- Piling Removal

5. Road and Trail Erosion Control, Maintenance, and Decommissioning

- a. Maintain Roads
- b. Decommission Roads

6. In-channel Nutrient Enhancement

- In-channel Nutrient Enhancement

7. Irrigation and Water Delivery/Management Actions

- a. Convert Delivery System to Drip or Sprinkler Irrigation
- b. Convert Water Conveyance from Open Ditch to Pipeline or Line Leaking Ditches or Canals
- c. Convert from Instream Diversions to Groundwater Wells for Primary Water Sources
- d. Install or Replace Return Flow Cooling Systems
- e. Install Irrigation Water Siphon Beneath Waterway
- f. Livestock Watering Facilities
- g. Install New or Upgrade/Maintain Existing Fish Screens

8. Fisheries, Hydrologic, and Geomorphologic Surveys

- Fisheries, Hydrologic, and Geomorphologic Surveys

9. Special Actions (Terrestrial Species)

- a. Install/develop Wildlife Structures
- b. Fencing Construction for Livestock Control
- c. Implement Erosion Control Practices
- d. Plant Vegetation
- e. Tree Removal for LW Projects

Project
Activity
Categories

VER 03.10

Note version.
Ver 3.10
current as of
2/22/16

3 of 4

NMFS Hydro Division Review

Does the project require approval from NMFS Hydro Division for:

Fish Passage Restoration (Profile Discontinuities)	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Approval Date: DATE
Install New or Upgrade/Maintain Existing Fish Screens	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Approval Date: DATE
Channel Reconstruction	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Approval Date: DATE

USFWS Terrestrial Species Review

Does the project require confirmation of NLAA Effects determination for:

Mammalian Species	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Approval Date: DATE
Invertebrate Species	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Approval Date: DATE
Avian Species	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Approval Date: DATE
Plant Species	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Approval Date: DATE

RRT REVIEW (for medium or high risk projects only)

Medium Risk Project requiring internal RRT review Yes No

High Risk project requiring inter-agency review? Yes No

Date of RRT submittal: DATE Date of RRT Approval: DATE RRT Reviewer:

BPA Determination of Consistency with all Requirements of the HIP III Consultation

The BPA must certify that the proposed project is consistent with all requirements and applicable terms and conditions of the HIP III Consultation.

BPA EC Contact (constitutes your electronic signature):

Date of Certification: DATE

Internal
BPA Use
Only

Once this has been signed and returned with HIP No# this document serves as proof of coverage.

2.8 Variance Requests.

Because of the wide range of proposed activities and the natural variability within and between stream systems, BPA (on behalf of the sponsor) may request variances from criteria specified by the HIP BiOps. The Services will consider granting variances, especially when there is a clear conservation benefit or there are no additional adverse effects (especially incidental take) beyond that analyzed in the BiOps. Contact your EC lead for more information.

Variance requests shall be made on the PNF, which shall then be submitted to and approved by the Services via email correspondence.

- 1) Define the requested variance and the relevant criterion.
- 2) Environmental conditions during when the action takes place (flow and weather).
- 3) Biological justification as to why a variance is necessary and a brief rationale why the variance will either provide a conservation benefit or, at a minimum, not cause additional adverse effects beyond the scope of the BiOps.
- 4) Include as attachments any necessary approvals by state agencies.

Variances must be authorized by both the NMFS Branch Chief and USFWS Field Office Supervisor with concurrence from BPA. In addition, variances that impact fish passage shall be submitted for NMFS Engineering Review.



Chapter 3 General Conservation Measures

3.1 General Conservation Measures Applicable to all Actions

These measures will be implemented on all projects covered under the HIP.

3.1.1 Project Design and Site Preparation

3.1.1.1 Timing of in-water work

Formal recommendations published by state agencies such as the Oregon Department of Fish and Wildlife (ODFW), Washington Department of Fish and Wildlife (WDFW), Idaho Department of Fish and Game (IDFG), and Montana Fish Wildlife and Parks (MFWP), or informal recommendations from the appropriate state Fishery Biologist in regard to the timing of in-water work, will be followed.

- 1) **Bull trout** - In Bull Trout spawning and rearing areas, eggs, alevin, and fry are present nearly year round. In Bull Trout habitats designated as foraging, migration, and overwintering (FMO) habitats, juvenile and adult bull trout may be present seasonally. Some project locations may not have designated in-water work windows for bull trout, or if they do, they may differ from the in-water work windows for salmon and steelhead. If this is the case, the project sponsor will contact the appropriate USFWS field office to ensure that all reasonable implementation measures are considered and an appropriate in-water work window is used to minimize project effects.
- 2) **Lamprey** – To minimize disturbance to migrant adults, the project sponsor and/or their contractors will avoid working instream or river channels that contain Pacific lamprey from March 1 to July 1 in low- to mid-elevation reaches (<5,000 feet). In high-elevation reaches (>5,000 feet), the project sponsor will avoid working instream or river channels from March 1 to August 1. If either timeframe is incompatible with other objectives, the area will be surveyed for nests and lamprey presence, and avoided if possible. If lampreys are known to exist, the project sponsor will utilize best management practices (BMPs) for dewatering and salvage as outlined in USFWS 2010¹, or most recent guidance. Salvage should include salvage of larval lamprey from sediments. (See section “Conservation Measures for Salvage of Native Fish, Lamprey, and Mussels”).
- 3) **A maximum of 1 week** past the recommended in-water work window shall be considered and approved by the EC lead, any other deviation from the IWWW shall considered and reviewed by the Services through the Variance Process.

¹ USFWS. 2010. Best management practices to minimize adverse effects to Pacific lamprey. Available online at: <http://www.fws.gov/pacific/Fisheries/sphabcon/lamprey/pdf/Best%20Management%20Practices%20for%20Pacific%20Lamprey%20April%202010%20Version.pdf>

3.1.1.2 Contaminants

The project sponsor will complete a site assessment with the following elements to identify the type, quantity, and extent of any potential contamination for any action that involves excavation of more than 20 cubic yards of material:

- 1) A review of available records, such as former site use, building plans, and records of any prior contamination events;
- 2) A site visit to inspect the areas used for various industrial processes and the condition of the property;
- 3) Interviews with knowledgeable people, such as site owners, operators, and occupants, neighbors, or local government officials; and
- 4) A summary, stored with the project file that includes an assessment of the likelihood that contaminants are present at the site, based on items 4(a) through 4(c).

3.1.1.3 Site layout and flagging

- 1) Prior to construction, the project area will be clearly flagged to identify the following:
- 2) Sensitive resource areas, such as areas below ordinary high water (OHW), spawning areas, springs, and wetlands;
- 3) Equipment entry and exit points;
- 4) Road and stream crossing alignments;
- 5) Staging, storage, and stockpile areas; and
- 6) No-herbicide-application areas and buffers.

3.1.1.4 Temporary access roads and paths

- 1) Existing access roads and paths will be preferentially used whenever possible, and the number and length of temporary access roads and paths through riparian areas and floodplains will be minimized to lessen soil disturbance, soil compaction, and impacts to vegetation.
- 2) Vehicle use and human activities, including walking in areas occupied by terrestrial ESA-listed species, will be minimized.
- 3) Temporary access roads and paths will not be built on slopes where grade, soil, or other features suggest a likelihood of excessive erosion or failure. If slopes are steeper than 30%, the road will be designed by a civil engineer with experience in steep road design.
- 4) The removal of riparian vegetation during construction of temporary access roads will be minimized. When temporary vegetation removal is required, vegetation will be cut at ground level (not grubbed).
- 5) At project completion, all temporary access roads and paths will be decompacted and reshaped to match the original contour; and the soil will be stabilized and revegetated.
- 1) Helicopter flight patterns will be established in advance, and located to avoid terrestrial ESA-listed species, including their occupied habitat and appropriate buffers, during sensitive life stages (i.e. nesting and critical breeding periods). See species-specific

conservation measures for each listed species that may occur within the project area for more information.

3.1.1.5 Temporary stream crossings

- 1) Existing stream crossings, fords, or bedrock will be used whenever possible.
- 2) If an existing stream crossing is not accessible, temporary crossings will be installed. Treated wood shall not be used on temporary bridge crossings or in locations in contact with or over water.
- 3) For projects that require equipment and vehicles to cross in the wet:
 - a) The location and number of all wet crossings must be approved by BPA and clearly indicated on design drawings.
 - b) Vehicles and machinery will cross streams at right angles to the main channel wherever possible.
 - c) No stream crossings will occur 300 feet upstream or 100-feet downstream of an existing redd or spawning fish.
 - d) After project completion, temporary stream crossings will be obliterated, and the banks restored.

3.1.1.6 Staging, storage, and stockpile areas

- 1) Staging areas (used for construction equipment storage, vehicle storage, fueling, servicing, and hazardous material storage) will be 150 feet or more from any natural waterbody or wetland, or on an adjacent established road area in a location and manner that will preclude erosion into, or contamination of, the stream or floodplain. **Staging areas may be closer than 150 feet if the area is above (elevation) the 100-yr floodplain and spill prevention measures are approved by the EC Lead.**
- 2) Natural materials used for implementation of aquatic restoration, such as large wood, gravel, and boulders, may be staged within 150 feet if clearly indicated in plans. Recommend referring to area as “Natural Material Stockpile Area” with a note that states vehicle storage, equipment storage, hazardous materials, fueling, and servicing not permitted in this area.
- 3) Any large wood, topsoil, and native channel material displaced by construction will be stockpiled for use during site restoration at a specifically identified and flagged area.
- 4) Any material not used in restoration, and not native to the floodplain, will be removed to a location outside of the 100-year floodplain for disposal.

3.1.1.7 Equipment

Mechanized equipment and vehicles will be selected, operated, and maintained in a manner that minimizes adverse effects on the environment (e.g., minimally-sized, low pressure tires; minimal hard-turn paths for tracked vehicles; temporary mats or plates within wet areas or on sensitive soils). All vehicles and other mechanized equipment will be:

- 1) Stored, fueled, and maintained in a vehicle staging area located 150 feet or more from any natural water body or wetland, or on an adjacent, established road area;
- 2) Refueled in a vehicle staging area located 150 feet or more from a natural waterbody or wetland, or in an isolated hard zone, such as a paved parking lot or adjacent, established road (this measure applies only to gas or diesel-powered equipment with tanks larger than 5 gallons);
- 3) Biodegradable lubricants and fluids² shall be used on equipment operating in the stream channel and live water.
- 4) Inspected daily for fluid leaks before leaving the vehicle staging area for operation within 150 feet of any natural water body or wetland; and
- 5) Thoroughly cleaned before operation below ordinary high water (OHW), and as often as necessary during operation, to remain free of grease.

3.1.1.8 Erosion control

Erosion control best management practices (BMPs) will be prepared and carried out, commensurate with the scope of the action that may include the following:

- 1) Temporary erosion control BMPs.
 - a) Temporary erosion control BMPs shall be in place before any significant alteration of the action site, and shall be appropriately installed downslope of project activity within the riparian buffer area until site rehabilitation is complete.
 - b) If there is a potential for eroded sediment to enter the stream, sediment barriers will be installed and maintained for the duration of project implementation.
 - c) Temporary erosion control measures may include sedge mats, fiber wattles, silt fences, jute matting, wood fiber mulch with soil binder, or geotextiles and geosynthetic fabric. Biodegradable netting may be used so that they can decompose on site.
 - d) Soil stabilization utilizing wood fiber mulch and tackifier (hydro-applied) may be used to reduce erosion of bare soil if the materials are noxious-weed-free and nontoxic to aquatic and terrestrial animals, soil microorganisms, and vegetation.
 - e) Sediment will be removed from erosion control BMP once it has reached 1/3 of the exposed height of the BMP.
 - f) Once the site is stabilized following construction, temporary erosion control BMPs will be removed.

² For additional information and suppliers of biodegradable hydraulic fluids, motor oil, lubricant, or grease. See, Environmentally Acceptable Lubricants by the U.S. EPA (2011); e.g., mineral oil, polyglycol, vegetable oil, synthetic ester; Mobil® biodegradable hydraulic oils, Total® hydraulic fluid, Terresolve Technologies Ltd.® biobased biodegradable lubricants, Cougar Lubrication® 2XT Bio engine oil, Series 4300 Synthetic Bio-degradable Hydraulic Oil, 8060-2 Synthetic Bio-Degradable Grease No. 2, etc.

- 2) Emergency erosion control BMPs. The following materials for emergency erosion control will be available at the work site:
 - a) A supply of sediment control materials; and
 - b) An oil-absorbing floating boom whenever surface water is present.

3.1.1.9 Dust abatement

The project sponsor will determine the appropriate dust control measures by considering soil type, equipment usage, prevailing wind direction, and the effects caused by other erosion and sediment control measures. In addition, the following criteria will be followed:

- 1) Work will be sequenced and scheduled to reduce exposed bare soil subject to wind erosion.
- 2) Dust-abatement additives and stabilization chemicals (typically magnesium chloride, calcium chloride salts, or lignin sulfonate) will not be applied within 25 feet of a natural waterbody or wetland and will be applied so as to minimize the likelihood that they will enter streams. Applications of lignin sulfonate will be limited to a maximum rate of 0.5 gallons per square yard of road surface, assuming a 50:50 (lignin sulfonate to water) solution.
- 3) Application of dust abatement chemicals will be avoided during or just before wet weather and at stream crossings or other areas that could result in unfiltered delivery of the dust abatement chemicals to a waterbody (typically these would be areas within 25 feet of a natural waterbody or wetland; distances may be greater where vegetation is sparse or slopes are steep).
- 4) Spill containment equipment will be available during application of dust abatement chemicals.
- 5) Petroleum-based products will not be used for dust abatement.

3.1.1.10 Spill prevention, control, and counter measures

The following measures will be used to prevent accidental spills of fuel, lubricants, hydraulic fluid³, or other contaminants into the riparian zone or directly into the water:

- 1) A description of hazardous materials that will be used, including inventory, storage, and handling procedures, will be available on-site.
- 2) Written procedures for notifying environmental response agencies will be posted at the work site.

³ For additional information and suppliers of biodegradable hydraulic fluids, motor oil, lubricant, or grease. See, Environmentally Acceptable Lubricants by the U.S. EPA (2011); e.g., mineral oil, polyglycol, vegetable oil, synthetic ester; Mobil® biodegradable hydraulic oils, Total® hydraulic fluid, Terresolve Technologies Ltd.® biobased biodegradable lubricants, Cougar Lubrication® 2XT Bio engine oil, Series 4300 Synthetic Bio-degradable Hydraulic Oil, 8060-2 Synthetic Bio-Degradable Grease No. 2, etc.

- 3) Spill containment kits (including instructions for cleanup and disposal) adequate for the types and quantity of hazardous materials used at the site will be available at the work site.
- 4) Workers will be trained in spill containment procedures and will be informed of the location of spill containment kits.
- 5) Any waste liquids generated at the staging areas will be temporarily stored under an impervious cover, such as a tarpaulin, until they can be properly transported to, and disposed of, at a facility that is approved for receipt of hazardous materials.
- 6) Pumps used adjacent to water shall use spill containment systems.

3.1.1.11 Invasive species control

The following measures will be followed to avoid introduction of invasive plants and noxious weeds into project areas:

- 1) Prior to entering the site, all vehicles and equipment will be power-washed, allowed to dry fully, and inspected to make sure no plants, soil, or other organic material adheres to the surface.
- 2) Watercraft, waders, boots, and any other gear to be used in or near water will be inspected for aquatic invasive species. Wading boots with felt soles are not to be used due to their propensity for aiding in the transfer of invasive species unless decontamination procedures are used.

3.1.2 Work Area Isolation & Fish Salvage

3.1.2.1 Work Area Isolation

Any work area requiring excavation or mobilization of sediment within the wetted channel will be isolated from the active stream whenever ESA-listed fish are reasonably certain to be present, or if the work area is less than 300-feet upstream from known ESA-listed fish spawning habitats. If the work area isolation practices would cause greater impacts than it would prevent, is located in deep or swiftly flowing water, or if fish can be effectively excluded by nets or screens, then a variance to not isolate the work area may be pursued.

Work area isolation & fish salvage activities are considered incidental to construction-related activities and shall occur during the state-recommended in-water work windows.

When work area isolation is required, design plans will include all isolation elements, fish release areas, a pump to be used to dewater the isolation area, and, when fish are present, a fish screen that meets NMFS's fish screen criteria (NMFS 2011⁴, or most current). Wider mesh screens may be used after all fish have been removed from the isolated area. Work area isolation and fish capture activities take place during periods of the coolest air and water temperatures

⁴ NMFS. 2011. Anadromous salmonid passage facility design. Northwest Region. Available online at: http://www.habitat.noaa.gov/pdf/salmon_passage_facility_design.pdf

possible, normally early in the morning versus late in the day, and during conditions appropriate to minimize stress to fish species present.

A fish biologist will determine how to remove ESA-listed fish, with least harm to the fish, before in-water work begins. This will involve either passive movement of fish out of the project reach through slow dewatering, or actively removing the fish from the project reach. Should active removal be warranted, a fish biologist will clear the area of fish before the site is dewatered using one or more of a variety of methods including seining, dipping, or electrofishing, depending on specific site conditions. In areas occupied by larval lamprey, to the extent possible, salvage using guidance set forth in USFWS 2010 or most recent guidance.

Dependent upon site conditions, a fish biologist will conduct or supervise the following:

- 1) Slowly reduce water from the work area to allow some fish to leave the work area voluntarily;
 - a) If dewatered area contains large fine/ sandy sediment deposits, larval lamprey could be present, and potentially in large numbers. If so, consider electrofishing using lamprey electrofishing settings (which do not affect bony fish) prior to or during drawdown. See section further down on Lamprey Conservation Measures and Electrofishing guidelines.
- 2) Install block nets;
 - a) Block nets will be installed at upstream and downstream locations and maintained in a secured position to exclude fish from entering the project area.
 - b) Block nets will be secured to the stream channel bed and banks until fish capture and transport activities are complete. Block nets may be left in place for the duration of the project to exclude fish.
 - c) If block nets remain in place more than one day, the nets will be monitored at least daily to ensure they are secured to the banks and free of organic accumulation. If the project is within bull trout spawning and rearing habitat, the block nets must be checked every 4 hours for fish impingement on the net. Less frequent intervals must be approved through a variance request.
 - d) Nets will be monitored hourly anytime there is instream disturbance.
- 3) Capture fish through seining, and relocate to streams;
 - a) While dewatering, any remaining fish will be collected by hand or dip nets.
 - b) Seines with a mesh size to ensure capture of the residing ESA-listed fish will be used.
 - c) Minnow traps may be left in place overnight and used in conjunction with seining.
- 4) Electrofish to capture and relocate fish not caught during seining, NMFS electrofishing guidelines shall be used. This step is to be used as a last resort; after all passive techniques have been exhausted.
- 5) Continue to slowly dewater the stream reach;

- 6) Collect any remaining fish in cold-water buckets and relocate to the stream;
 - a) Limit the time fish would be in a transport bucket , and release them as quickly as possible;
 - b) The number of fish within a bucket will be limited, and fish will be of relatively comparable size to minimize predation;
 - c) Aerators for buckets will be used, or the bucket's water will be frequently changed with cold, clear, water at 15 minute, or more-frequent, intervals.
 - d) Buckets will be kept in shaded areas; or if in exposed areas, covered by a canopy.
 - e) Dead fish will not be stored in transport buckets but will be left on the streambank to avoid mortality counting errors.



3.1.2.2 NMFS's Electrofishing Guidelines (NMFS 2000⁵)

- 1) Initial Site Surveys and Equipment Settings
 - a) In order to avoid contact with spawning adults or active redds, researchers must conduct a careful visual survey of the area to be sampled before beginning electrofishing.
 - b) Prior to the start of sampling at a new location, water temperature and conductivity measurements shall be taken to evaluate electrofisher settings and adjustments.

⁵ http://www.westcoast.fisheries.noaa.gov/publications/reference_documents/esa_refs/section4d/electro2000.pdf

- c) No electrofishing should occur when water temperatures are above 18°C or are expected to rise above this temperature prior to concluding the electrofishing survey.
- d) Whenever possible, a block net should be placed below the area being sampled to capture stunned fish that may drift downstream.
- e) Equipment must be in good working condition and operators should go through the manufacturer's preseason checks, adhere to all provisions, and record major maintenance work in a logbook.
- f) Each electrofishing session must start with all settings (voltage, pulse width, and pulse rate) set to the minimums needed to capture fish (Table 1). These settings should be gradually increased only to the point where fish are immobilized and captured, and generally not allowed to exceed conductivity-based maxima.

Table 1 Guidelines for initial and maximum settings for backpack electrofishing for salmonids.

	Initial Settings	Maximum Settings	
Voltage		<u>Conductivity</u>	<u>Max Voltage</u>
	100V	<100	1100 V
		100-300	800 V
		>300	400 V
Pulse Width	500 µS	5 mS	
Pulse Rate	30 Hz	70 Hz	

2) Electrofishing Technique

- a) Sampling should begin using straight DC. The power needs to remain on until the fish is netted when using straight DC. If fish capture is unsuccessful with initial low voltage, gradually increase voltage settings with straight DC.
- b) If fish capture is not successful with the use of straight DC, then set the electrofisher to lower voltages with PDC. If fish capture is unsuccessful with low voltages, increase pulse width, voltage, and pulse frequency (duration, amplitude, and frequency).
- c) Electrofishing should be performed in a manner that minimizes harm to the fish. Stream segments should be sampled systematically, moving the anode continuously in a herringbone pattern (where feasible) through the water. Care should be taken when fishing in areas with high fish concentrations, structure (e.g., wood, undercut banks) and in shallow waters where most backpack electrofishing for juvenile salmonids occurs. Voltage gradients may be high when electrodes are in shallow water where boundary layers (water surface and substrate) tend to intensify the electrical field.
- d) Do not electrofish in one location for an extended period (e.g., undercut banks) and regularly check block nets for immobilized fish.

- e) Fish should not make contact with the anode. The zone of potential injury for fish is 0.5 m from the anode.
 - f) Electrofishing crews should be generally observant of the condition of the fish and change or terminate sampling when experiencing problems with fish recovery time, banding, injury, mortality, or other indications of fish stress.
 - g) Netters should not allow the fish to remain in the electrical field any longer than necessary by removing stunned fish from the water immediately after netting.
- 3) Sample Processing and Recordkeeping
- a) Fish should be processed as soon as possible after capture to minimize stress. This may require a larger crew size.
 - b) All sampling procedures must have a protocol for protecting held fish. Samplers must be aware of the conditions in the containers holding fish; air pumps, water transfers, etc., should be used as necessary to maintain safe conditions. Also, large fish should be kept separate from smaller prey-sized fish to avoid predation during containment.
 - c) Fish should be observed for general condition and injuries (e.g., increased recovery time, dark bands, and visually observable spinal injuries). Each fish should be completely revived before releasing at the location of capture. A plan for achieving efficient return to appropriate habitat should be developed before each sampling session. Also, every attempt should be made to process and release ESA-listed specimens first.
 - d) Pertinent water quality (e.g., conductivity and temperature) and sampling notes (e.g., shocker settings, fish condition/injuries/mortalities) should be recorded in a logbook to improve technique and help train new operators. It is important to note that records of injuries or mortalities pertain to the entire electrofishing survey, including the fish sample work-up.
 - e) The anode will not intentionally contact fish.
 - f) Electrofishing should not be conducted when the water conditions are turbid and visibility is poor. For example, when the sampler cannot see the stream bottom in one foot of water.
 - g) If mortality or obvious injury (defined as dark bands on the body, spinal deformations, de-scaling of 25% or more of body, and torpidity or inability to maintain upright attitude after sufficient recovery time) occurs during electrofishing, operations will be immediately discontinued, machine settings, water temperature, and conductivity checked, and procedures adjusted or electrofishing postponed to reduce mortality.

3.1.2.3 Dewatering

Dewatering, when necessary, will be conducted over a sufficient period of time to allow species to naturally migrate out of the work area and will be limited to the shortest linear extent practicable.

- 1) Diversion around the construction site may be accomplished with a cofferdam and a bypass culvert or pipe, or a lined, non-erodible diversion ditch. Where gravity feed is not possible, a pump may be used, but must be operated in such a way as to avoid repetitive dewatering and rewatering of the site. Impoundment behind the cofferdam must occur slowly through the transition, while constant flow is delivered to the downstream reaches.
- 2) All pumps will have fish screens to avoid juvenile fish impingement or entrainment, and will be operated in accordance with NMFS's current fish screen criteria (NMFS 2011, or most recent version). If the pumping rate exceeds 3 cubic feet per second (cfs), a NMFS Engineering review will be necessary. If the screen is in an isolated area with no fish (salmonids or larval lamprey), a larger mesh screen may be used.
- 3) Dissipation of flow energy at the bypass outflow will be provided to prevent damage to riparian vegetation and/or stream channel.
- 4) Seepage water will be pumped to a temporary storage and treatment site or into upland areas to allow water to percolate through soil or to filter through vegetation prior to reentering the stream channel.
- 5) In areas occupied by larval lamprey, to the extent possible, salvage using guidance described in above section "Conservation Measures for Salvage of Native Fish, Lamprey and Mussels" (which is based on USFWS 2010) or most recent guidance.
- 6) In areas occupied by native freshwater mussels, to the extent possible, salvage using guidance developed by the Xerces Society (Blevins et al. 2018, 2019).

3.1.2.4 Bull Trout Electrofishing Conservation Measures

- 1) For salvage operations in known bull trout spawning and rearing habitat⁶, electrofishing shall only occur from May 1 to July 31. In FMO habitats, electrofishing may occur any time of year.
- 2) Bull trout are very temperature sensitive and generally should not be electrofished or otherwise handled when temperatures exceed 15°C in spawning and rearing habitats.
- 3) Salvage activities should take place during periods of the coolest air and water temperatures possible, normally early in the morning versus late in the day, and during conditions appropriate to minimize stress to fish species present.

3.1.2.5 Salvage of Native Fish, Lamprey⁷ and Mussels⁸

⁶ Bull Trout Spawning and Rearing habitat is not foraging, migrating, and overwintering (FMO) habitats.

⁷ For lamprey, see USFWS. 2010. Best management practices to minimize adverse effects to Pacific lamprey or the latest revision: Available online at:

In addition to Conservation Recommendations for salmonids, additional efforts will be employed to salvage other native species. The following guidelines are draft from the U.S. Fish and Wildlife Service, with assistance from the Xerces Society, and will be used as appropriate and to the extent possible.

- 1) Conduct native mussel and lamprey presence/ absence; approximate numbers for salvage to aid in planning for salvage. Pre-select site where salvaged mussels will be relocated.
- 2) Suggested drawdown: this order should be adjusted for site-specific conditions and numbers of species and individuals- for example, if you only have a small number of mussels or very limited larval lamprey habitat, it may be most efficient to salvage only during drawdown. If drawdown occurs during cool, wet weather, and the area will be rewatered within 24-48 hours, mussels and larval lamprey may survive in the sediments, and not require salvage. Conversely, if conditions are warm or hot, lamprey can expire within a couple of hours. Depending on your site and circumstances, other adjustments may also be necessary. A generalized order prior to drawdown is:
 - a) Salvage FW mussels by hand, locating by snorkeling or wading. If mussels are numerous (or staff is limited), it may be necessary to do this step in the days before drawdown, as relocation/placement can be time consuming.
 - b) Salvage larval lamprey by e-fisher under watered conditions with lamprey-specific settings.
 - c) Salvage bony fish after lamprey with nets or by e-fisher with appropriate settings.
 - d) If there are sufficient numbers of people and equipment, some people can be dry-shocking dewatered areas, while others are removing remaining mussels, and others are salvaging salmon.
- 3) Continue salvage larval lamprey and FW mussels by hand during and after drawdown, as water recedes and lamprey continue to emerge from sediments and overlooked mussels become visible. Larval lamprey may emerge hours after dewatering occurs.
- 4) To encourage larval lamprey emergence, “Dry shock” in areas of fine/sandy deposits that are likely to have high larval lamprey densities.
- 5) Hold all fish in buckets, fine mesh baskets or tanks with adequate temperatures, space and oxygen. Release all fish throughout the salvage process in appropriate habitats to minimize stress, thermal shock and predation risk. Hold mussels in coolers as described below and relocate mussels in a pre-selected appropriate habitat; placement of each individual is needed to allow mussels to re-establish/burrow into the new habitat.

<http://www.fws.gov/pacific/Fisheries/sphabcon/lamprey/pdf/Best%20Management%20Practices%20for%20Pacific%20Lamprey%20April%202010%20Version.pdf>

⁸ For mussels, see Blevins et al. 2018. Conserving the Gems of Our Waters: Best Management Practices for Protecting Native Western Freshwater Mussels, and Blevins et al. 2019. Mussel-Friendly Restoration. Both available on line at <https://xerces.org/western-freshwater-mussels/>

Electrofishing settings for larval Lamprey

- 1) Electrofishing should be performed in a manner that minimizes harm to fishes. Handling techniques as described in NMFS Electrofishing Guidelines are protective of lamprey. If there is a conflict between conservation measures for ESA-listed salmonids and lamprey/mussels notify EC Lead and prioritize protections towards the ESA-listed fish.
- 2) Generally three types of electrofishers are suitable for larval lamprey sampling⁹:
 - a) AbP-2 “Wisconsin” electrofisher (ETS Electrofishing, Verona, WI)
 - b) Smith-Root LR-24 model electrofisher with lamprey settings;
 - c) Smith Root Apex Backpack electrofisher with lamprey settings.
- 3) Electrofishers used for larval lamprey sampling should be set with two wave forms, a lower frequency “tickle” wave form to coax larval lampreys out of the substrate and a higher frequency “stun” wave form to immobilize larval lampreys for netting.
- 4) Effective sampling involves this 2-stage method (Table 2):
 - a) First stage: use 125V direct current with a 25 percent duty cycle applied at a slow rate of 3 pulses per second, to induce larval lampreys to emerge from the sediment. At low water temperature (<10C°), voltage may need to be raised (150-200V) to maintain its effectiveness (gradually increase voltage to find the appropriate setting to avoid the risk of electronarcosis).
 - b) Use a pattern of 3 slow pulses followed by a skipped pulse (burst pulse) helps larval lampreys to emerge.
 - c) Second stage: immediately after larval lampreys emerge, use a fast pulse setting of 30 pulses per second to immobilize and net them. It is not necessary to stun lamprey for netting for experienced netters.

Table 2: Electrofishing Guidelines for Larval Lampreys.

	“Tickle” Burst Slow Pulse Primary Wave Form	“Stun” Standard Fast Pulse Secondary Wave Form
Voltage	125 v	125 v
Pulse Frequency	3 Hz	30 Hz
Duty Cycle	25%	25%
Burst Pulse Train	3:1	X
Maximum duration/set	60-90seconds	

NOTE: Settings are too low to effect salmonid species and other bony fishes.

⁹ Information on set up can be found at <https://www.smith-root.com/support/kb/setting-up-a-backpack-electrofisher-to-capture-larval-lamprey/>

- 5) Avoid exposing larval lampreys to extended periods of electrofishing as it has also been linked to electronarcosis. Recovery from electronarcosis takes about 15 minutes.
- 6) Use dip nets to capture larval lampreys where they are readily visible. Where not visible, seines may be effective. Using fine mesh nets to “sweep” the water (“blind-netting”) may increase the number of small larvae collected.
- 7) Within each reach, electrofishing should be conducted in a downstream to upstream direction (for the purpose of reducing turbidity/maintaining visibility) with one person operating the electrofisher and at least one person netting larval lampreys. Each reach should be thoroughly and slowly sampled (60-90 sec/m), with more effort directed at suitable lamprey rearing habitat and less effort in areas with hard substrates or high water velocity.
- 8) Using the 2-stage method described above, the electrofisher should mainly be operated in the lower frequency output mode to irritate larval lampreys out of the substrate. When necessary, the higher frequency mode should be activated for capturing emergent larval lampreys.
- 9) Multiple electrofishing passes should be made to ensure a more complete removal of larval lampreys. A fifteen minute break between passes should be taken to reduce the chance of electronarcosis. Some research indicated on average, only 30% lamprey emerge per pass, thus the need for multiple passes.
- 10) Post-Drawdown: Larval lamprey may continue to emerge from sediments after drawdown. The following “Dry- Shocking” Guidelines can be used to encourage larvae to emerge from the sediments so they can be salvaged.
 - a) During and after dewatering, dewatered areas where lamprey may be burrowed should be shocked, aka “dry-shocking.” Dry shock in depositional areas of fine and sandy sediment for larval lamprey. Juveniles (eyed migrants) and adults are sometimes found buried in rockier areas, and those areas should also be shocked if other these life stages may be present.
 - b) Dry-shock a square meter at a time. Place the anodes about 1 meter apart and tickle-pulse for 60 to 90 seconds. Remove emerged lamprey once the shocking has stopped. Move to next square meter and continue. Adjust to local conditions – in some instances, 60 seconds of shocking will be sufficient; in other areas 90 seconds is needed. In cold temperatures, it can be beneficial to raise the voltage to increase efficiency. A general guideline is at temperatures less than 100C, the voltage can be increased to 150-175 V. If emergence is really slow (or on the last salvage pass prior to complete dewatering), the voltage can be increased to 200 V initially, and up to 400 V if lower voltage is not effective (dry shocking only).

3.1.2.6 Fish Salvage Notice

Monitoring and recording of fish presence, handling, and mortality must occur for the duration of the isolation, salvage, electrofishing, dewatering, and rewatering operations. Once operations are completed, a salvage report will document procedures used, any fish injuries or deaths (including numbers of fish affected), and causes of any deaths.

3.1.3 Construction and Post-Construction Conservation Measures

3.1.3.1 Fish passage

Fish passage will be provided for any adult or juvenile fish likely to be present in the project area during construction, unless passage did not exist before construction, or the stream is naturally impassable at the time of construction. If the provision of temporary fish passage during construction will increase negative effects on ESA-listed species or their habitat, a variance can be requested from the NMFS Branch Chief and the USFWS Field Office Supervisor. Pertinent information, such as the species affected, length of stream reach affected, proposed time for the passage barrier, and alternatives considered will be included in the variance request.

3.1.3.2 Construction and discharge water

- 1) Surface water may be diverted to meet construction needs, but only if developed sources are unavailable or inadequate.
- 2) Diversions will not exceed 10% of the available flow.
- 3) All construction discharge water will be collected and treated using the best available technology suitable for site conditions.
- 4) Treatments to remove debris, nutrients, sediment, petroleum hydrocarbons, metals and other pollutants likely to be present will be provided.

3.1.3.3 Minimize time and extent of disturbance

Earthwork (including drilling, excavation, dredging, filling and compacting) in which mechanized equipment is used in stream channels, riparian areas, and wetlands will be completed as quickly as possible. Mechanized equipment will be used 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 alternatives. To the extent feasible, mechanized equipment will work from the top of the bank, unless work from another location would result in less habitat disturbance.

3.1.3.4 Cessation of work

Project operations will cease under the following conditions:

- 1) High flow conditions that may result in inundation of the project area, except for efforts to avoid or minimize resource damage

- 2) When allowable water quality impacts, as defined by the state CWA section 401 water quality certification or HIP Turbidity Monitoring Protocol, have been exceeded

3.1.3.5 Site restoration

When construction is complete:

- 1) All streambanks, soils, and vegetation will be cleaned up and restored as necessary using stockpiled large wood, topsoil, and native channel material.
- 2) All project-related waste will be removed.
- 3) All temporary access roads, crossings, and staging areas will be decompacted and re-contoured. When necessary for revegetation and infiltration of water, compacted areas of soil will be loosened.
- 4) All disturbed areas will be rehabilitated in a manner that results in similar or improved conditions relative to pre-project conditions. This will be achieved through redistribution of stockpiled materials, seeding, and/or planting with local native seed mixes or plants.

3.1.3.6 Revegetation

Long-term soil stabilization of disturbed sites will be accomplished with reestablishment of native vegetation using the following criteria:

- 1) Planting and seeding will occur prior to or at the beginning of the first growing season after construction.
- 2) Use a mix of species, appropriate to the site that will achieve establishment, shade, and erosion control objectives. These would, preferably be forb, grass, shrub, or tree species native to the project area or region.
- 3) Vegetation, such as willow, sedge and rush mats, will be salvaged from disturbed or abandoned floodplains, stream channels, or wetlands, and replanted at the site in appropriate locations.
- 4) Invasive species will not be used.
- 5) Short-term stabilization measures may include the use of non-native sterile seed mix (when native seeds are not available), weed-free certified straw, jute matting, and other similar techniques.
- 6) Surface fertilizer will not be applied within 50 feet of any stream channel, waterbody, or wetland.
- 7) Fencing will be installed as necessary to prevent access to revegetated sites by livestock or unauthorized persons.
- 8) Re-establishment of vegetation in disturbed areas will achieve at least 70% of pre-project conditions within 3 years.
- 9) Invasive plants will be removed or controlled until native plant species are well-established (typically 3 years post-construction).

3.1.3.7 Site access

The project sponsor will retain the right of reasonable access to the site in order to monitor the success of the project over its life.

3.1.3.8 Implementation monitoring

Project sponsor staff or their designated representative will provide implementation monitoring by filling out the Project Completion Form (PCF) to ensure compliance with the applicable BiOp, demonstrating that:

- 1) General conservation measures are adequately followed.
- 2) Effects to listed species are not greater than predicted and incidental take limitations are not exceeded.
- 3) Turbidity monitoring is being conducted in accordance with the HIP turbidity monitoring protocol (Section 3.3, pg. 44) and recorded in the PCF.

3.1.3.9 CWA section 401 water quality certification

The project sponsor or designated representative will complete and record water quality observations to ensure that in-water work is not degrading water quality. During construction, CWA section 401 water quality certification provisions provided by the Oregon Department of Environmental Quality, Washington Department of Ecology, or Idaho Department of Environmental Quality will be followed.



3.2 Staged Rewatering Plan

When appropriate, the project sponsor shall implement a staged rewatering plan for projects that involve introducing streamflow into recently excavated channels under the 2a) Improve Secondary Channel and Wetland Habitat Activity category or 2f) Channel Reconstruction categories. This plan may be altered according to site specific conditions with coordination and feedback from BPA and the Services.

- 1) Pre-wash the newly-excavated channel before rewatering¹⁰. Turbid wash water will be detained and pumped to the floodplain or into a reach with sediment capture devices, rather than discharging into fish-bearing waters.
- 2) Prepare new channel for water by installing seine nets at the upstream end to prevent fish from moving downstream into the new channel until 2/3 of total streamflow is available in that channel. Starting in the early morning, introduce 1/3 of the flow into the new channel over a period of 1-2 hours.
- 3) When reintroducing streamflow into a dewatered stream reach, monitor for turbidity:
 - a) A sample must be taken to establish background turbidity levels prior to anticipated turbidity pulses. Take the sample at an undisturbed area approximately 100 feet upstream from the newly excavated channel.
 - b) Take a second sample or observation, immediately downstream of the newly excavated channel, approximately:
 - c) 50 feet downstream for streams that are less than 30 feet wide;
 - d) 100 feet downstream for streams between 30 and 100 feet wide;
 - e) 200 feet downstream for streams greater than 100 feet wide; and
 - f) 300 feet from the discharge point or nonpoint source for locations subject to tidal or coastal scour.
 - g) A sample must then be taken every **2 hours** during rewatering and be compared against the background measurement.
 - h) An exceedance occurs whenever **both** of the following conditions are exceeded:
 - i) Downstream turbidity exceeds 40 NTU (Figure 1).
 - j) Downstream turbidity exceeds 10% above background.
 - k) In an exceedance occurs for two consecutive readings (4 hours), stop work immediately and take measures to reduce turbidity before continuing to reintroduce streamflow.
- 4) Prepare to introduce the second 1/3 of the flow (up to a total of 2/3) to the new channel by installing seine nets at the upstream end of the old channel in order to prevent fish, larval lamprey and freshwater mussels from moving into a partially-dewatered channel. Introduce the second 1/3 of the flow over the next 1-2 hours. Salvage fish from the old

¹⁰ The contractor may find it useful to have prewashed gravel bags available onsite to control the flow of water.

channel at this time, so that the old channel is fish-free before dropping below 1/3 of the flow.

Note: the fish will be temporarily blocked from moving downstream into either channel until 2/3 of the flow has been transitioned to the new channel. This blockage to downstream fish passage is expected to persist for roughly 12 to 14 hours, but fish will still be able to volitionally move out of the channel in the downstream direction. Perform monitoring as in #3 above.

- 5) After the second 1/3 of flow is introduced over 2 hours, and turbidity is within 10% of the background level, remove seine nets from the new channel, and allow fish to move downstream back into the channel.

Introduce the final 1/3 of flow. Once 100% of the flow is in the new channel, install plug to block flow into the old channel and remove seine nets from the old channel. Additional efforts to salvage larval lamprey emerging from fine sediment deposits should be conducted after the flow is gone and possibly for a few hours after flow is gone, as the larvae will continue to emerge.

3.3 HIP Turbidity Monitoring Protocol

The Project Sponsor shall complete and record the following water quality observations on the HIP 4 Project Completion Form (PCF). If the geomorphology of the project area (e.g., silty or claylike materials) or the nature of the action (e.g., large amounts of bare earth exposure) shall preclude the successful compliance with these triggers, notify your EC Lead & the Services in advance of the likelihood of an exceedance and seek additional recommendations.

- 1) Take a background turbidity measurement approximately 100 feet upstream from the project area using a recently-calibrated turbidimeter. Record the observation, location, and time of the background measurement before monitoring at the downstream point, known as the **measurement compliance point**. If the background turbidity is less than 20 NTU, then use visual observations (Figure 1).
- 2) Take a second measurement or observation at the **measurement compliance point**, immediately downstream of the disturbance area, approximately:
 - a) 50 feet downstream for streams that are less than 30 feet wide;
 - b) 100 feet downstream for streams between 30 and 100 feet wide;
 - c) 200 feet downstream for streams greater than 100 feet wide; and
 - d) 300 feet from the discharge point or nonpoint source for locations subject to tidal or coastal scour.
 - e) Record the downstream observation, location, and time.
- 3) Turbidity shall be measured (steps 1-2) every **2 hours**¹¹ while work is being implemented.

¹¹ The monitoring interval of 4 hours has been proposed but not approved.

- 4) An exceedance occurs whenever both of the following conditions are exceeded:
- Downstream turbidity exceeds 40 NTU,
 - Downstream turbidity exceeds 10% above background

Figure 1 Suggested Visual Observational Differences in Turbidity



NOTE: For any stream with a background turbidity of 20 NTU or less, if you cannot see the bottom in 2 feet of water at each 2 hour interval, then turbidity has likely surpassed 40 NTUs and you must adjust your procedures. This would allow work to continue with a turbidity of under about 30-40 NTU. Turbidity over 40 NTU should be avoided.

- 1) If an exceedance occurs then adjustments or corrective measures must be taken in order to reduce turbidity. The NMFS staff biologists of the area can provide technical assistance.
- 2) If exceedances occur for more than **two consecutive monitoring intervals** (after 4 hours), the activity must stop until the turbidity level returns to background, and the EC lead must be notified after the project is concluded. The EC lead shall document the reasons for the exceedances and the **corrective measures** taken. This is very important as BPA is required to report to the Services upon all exceedances.

- 3) If at any time, monitoring, inspections, or observations/samples show that the turbidity controls are ineffective, immediately mobilize work crews to repair, replace, or reinforce controls as necessary. Document those occurrences in the Project Completion Form(PCF).



Chapter 4 Activity-Specific Conservation Measures

4.1 Category 1: Fish Passage Restoration

4.1.1 Profile Discontinuities

BPA proposes to review and fund fish passage projects for ESA-listed salmon, steelhead, and bull trout (“salmonids”). The objective of fish passage restoration is to allow all life stages of salmonids access to historical habitat from which they have been excluded and focuses on restoring safe upstream and downstream fish passage to stream reaches that have become isolated by obstructions, non-functioning structures, or instream profile discontinuities resulting from insufficient depth, or excessive jump heights and velocities. These projects should also incorporate Pacific lamprey passage in the design and implementation, where appropriate.¹²

Although passage actions are generally viewed as positive actions for native fish restoration, there may be occasions where restoring passage exposes native fish (isolated above or below a barrier) to negative influences (predation, competition, hybridization) from non-native species such as brook trout, brown trout, and lake trout.

Proposed passage projects that may increase connectivity between bull trout and non-native species must be approved by the appropriate USFWS Field Office Supervisor.

BPA has grouped passage projects according to the effects and review requirements in the following subcategories: **Profile Discontinuities** and **Transportation Infrastructure**. These subcategories represent a logical break between transportation-related effects (transportation infrastructure) and effects due to physical fish barriers, classified by water velocity, water depth, and barrier height (profile discontinuities).

BPA proposes the following activities to improve fish passage; (a) Dam, Water Control or Legacy Structure Removal; (b) Consolidation, or Replacement of Existing Irrigation Diversions; (c) Headcut and Grade Stabilization; (d) Low Flow Consolidation; and (e) Fish passage provision at an existing facility.

4.1.2 Category 1a) Dams, Water Control Structures, or Legacy Structures Removal

Description

BPA proposes to fund and review fish passage projects, and restore more natural channel and flow conditions by removing small dams, channel-spanning weirs, earthen embankments, subsurface drainage features, spillway systems, tide gates, outfalls, pipes, instream flow redirection structures (e.g., drop structure, gabion, groin), or similar devices used to control, discharge, or maintain water levels.

¹² *Practical guidelines for incorporating adult Pacific lamprey passage at fishways* (Pacific Lamprey Technical Workgroup 2017) (<https://www.fws.gov/pacificlamprey/mainpage.cfm>); and *Effectiveness of common fish screen materials to protect lamprey ammocoetes* (Rose and Mesa 2012).

“Small dams” include instream structures (1) up to 15 feet in height (as measured at the maximum difference between water surface elevations upstream and downstream of the dam during low flow) for streams with a slope less than 4%¹³ downstream, or (2) up to 16.4 feet in height for streams with a slope greater than 4%.

If the structure being removed contains material (i.e. large wood, boulders, etc.) that is typically found within the stream or floodplain at that site, the material can be reused to implement habitat improvements. Any such project must follow the design criteria outlined in the “**Install Habitat-Forming Natural Material Instream Structures (Large Wood, Boulders, and Spawning Gravel)**” activity category.



Guidelines for Review

- **Low Risk:** Removal of instream structures such as subsurface drainage features, tide gates, outfalls, pipes, small dams with total head measurement < 3 feet.
- **Medium Risk:** Removal of instream structures that will not result in significant hydrological and geomorphic impacts > 3 feet will require both BPA and NMFS Engineering Review.
- **High Risk:** Removal of small dams > 3 feet and <15 feet in height for streams with an active channel width of < 75 feet and a slope <4%, or >3 feet and < 16.4 feet in height with a slope greater than 4% and an active channel width of <75 feet will require both BPA and NMFS Engineering Review.

¹³ Measured over 10 bankful widths upstream and 10 bankful widths downstream

All medium to high risk projects shall address the **Basis of Design Requirements** and require **BPA Engineering Review**.

Conservation Measures

- 1) In the design plans, the profile of the stream channel thalweg shall be shown to provide enough information to clearly demonstrate project impacts to the stream channel and the potential for channel degradation, for a minimum of 10 upstream and 10 downstream channel widths of the downstream and upstream boundaries of the project.
- 2) Surveys must be taken of any downstream spawning areas that may be affected by sediment released by removal of the water control structure or dam.
- 3) Sediment characterization must demonstrate the proportion of coarse sediment (>2mm) in the reservoir area. Reservoirs with a D35 greater than 2 mm (i.e., 65% of the sediment by weight exceeds 2 mm in diameter) may be removed without excavation of stored material, if the sediment contains no contaminants. Reservoirs with a D35 less than 2 mm (i.e., 65% of the sediment by weight is less than 2 mm 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.
- 4) Restore all structure bank lines and fill in all holes with native materials to restore contours of streambank and floodplain. Compact the fill material adequately to prevent washing out of the soil during over-bank flooding. Do not mine material from the stream channel to fill in “key” holes. When removal of buried (keyed) structures could result in significant disruption to riparian vegetation and/or the floodplain, consider leaving the buried structure 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 by using the appropriate guidance.¹⁴ If headcutting and channel incision are likely to occur due to structure removal, additional measures must be taken to reduce these impacts. See grade control options described under **Headcut and Grade Stabilization** activity category 1c.
- 6) If the structure is being removed because it has caused an over-widening of the channel, consider implementing other HIP 4 restoration categories to decrease the width-to-depth ratio of the stream at that location to a level similar to the natural and representative upstream and downstream sections of the stream, within the same channel type.
- 7) Tide gates can only be removed, but not modified or replaced, under this activity category.

¹⁴ Castro, J. 2003. Geomorphologic Impacts of Culvert Replacement and Removal: Avoiding Channel Incision. Oregon Fish and Wildlife Office, Portland, OR. Available at: <http://library.fws.gov/pubs1/culvert-guidelines03.pdf>

4.1.3 Category 1b) Consolidate, or Replace Existing Irrigation Diversions

Description

BPA proposes to fund and review the consolidation or replacement of existing diversion check structures with pump stations or engineered riffles (including cross vanes, “W” weirs, or “A” frame weirs) to reduce the number of diversions on streams and thereby conserve water and improve habitat for fish; improve the design of diversions (with adequate fish-screening) to allow for fish passage ; or reduce the annual instream construction of push-up dams and instream structures.

The HIP 4 will only cover irrigation efficiency actions within this activity category that use state-approved regulatory mechanisms (e.g., Oregon ORS 537.455-.500, Washington RCW 90.42) for ensuring that water savings will be protected as instream water rights, or in cases where project implementers identify how the water conserved will remain instream to benefit fish without any significant loss of the instream flows to downstream diversions.

Unneeded or abandoned irrigation diversion structures will be removed where they are barriers to fish passage; have created wide, shallow, channels or simplified habitat; or are causing sediment concerns through downstream scour or deposition behind the structure according to **Dams, Water Control Structures, or Legacy Structures Removal** section (Category 1a).

Lay-flat stanchions are not covered under HIP.



Guidelines for Review

- ***Low Risk:*** Removal or replacement of irrigation diversion structures less than 3 feet in height.
- ***Medium Risk:*** Removal or replacement of irrigation diversion structures greater than 3 feet in height will require both BPA and NMFS Engineering Review.

All medium to high risk projects shall address Section 2.5 **Basis of Design Report (BDR)** Requirements on page 16.

Conservation Measures

- 1) For removal of channel spanning diversion structures greater than 3 feet in height, the profile of the stream channel thalweg in the design plan shall be shown to provide enough information to clearly demonstrate project impacts to the stream channel, and the potential for channel degradation for a minimum for (10) upstream and (10) downstream channel widths of the upstream and downstream boundaries of the project.
- 2) Diversion structures shall be designed to meet NMFS Anadromous Salmonid Passage Facility Design Guidelines (NMFS 2011 or more recent version)¹⁵ and, where appropriate, *Guidelines for incorporating adult Pacific lamprey passage at fishways (PLTW 2017)*¹⁶.
- 3) In order to reduce entrainment of larval lamprey, the use of wire cloth for screening should be avoided; perforated plate, vertical bar or interlocking bar screens should be used instead (Rose and Mesa 2012).
- 4) Placement of rock structures or engineered riffles shall follow criteria outlined in the Headcut and Grade Stabilization activity category 1c.
- 5) Project design shall include the installation of a totalizing flow meter on all diversions for which installation of this device is possible. A staff gauge or other device capable of measuring instantaneous flow will be utilized on all other diversions.
- 6) Multiple existing diversions may be consolidated into one diversion if the consolidated diversion is located at the most downstream existing diversion point unless sufficient water is available to support unimpeded passage at low flows. The design will clearly identify the low flow conditions within the stream reach relative to the cumulative diverted water right. If instream flow conditions are proven favorable for fish passage and habitat use, then diversion consolidation may occur upstream of the lowest original structure.

¹⁵ NMFS. 2011. Anadromous Salmonid Passage Facility Design. NMFS, Northwest Region, Portland, Oregon. Available at: http://www.westcoast.fisheries.noaa.gov/publications/hydropower/fish_passage_design_criteria.pdf

¹⁶ *Practical guidelines for incorporating adult Pacific lamprey passage at fishways* (Pacific Lamprey Technical Workgroup 2017) (<https://www.fws.gov/pacificlamprey/mainpage.cfm>); and *Effectiveness of common fish screen materials to protect lamprey ammocoetes* (Rose and Mesa 2012).

- 7) Diversions will be designed to incorporate Point of Diversion (POD) flow restrictions to limit the diverted flow to satisfy the irrigator's water right at the 95% exceedance stream flow stage. Diversion flow restriction may be accomplished by any practical means available but must be supported by hydraulic calculations and a stage rating curve. POD flow restriction may be accomplished by:
- 8) Incorporation of a restricted orifice plate or screen at the POD that provides at a maximum, the required area to pass the irrigator's water right;
- 9) Mechanically restricting the opening of a variable head gate to the maximum area required to pass the irrigator's water right; or
- 10) Any other method that will satisfy the intent of the diversion flow governance requirement that can be justified by the design documents.
- 11) Treated wood and copper- or zinc-plated hardware shall not be used in the construction of irrigation diversions. Concrete must be sufficiently cured or dried (48-72 hours depending on temperature) before coming into contact with stream flow.
- 12) Irrigation diversion intake and return points will be designed or replaced to prevent fish and other aquatic organisms of all life stages from swimming or being entrained in the irrigation system. Fish screens for surface water that is diverted by gravity or by pumping at a rate that exceeds 3 cfs will be submitted to NMFS for review and approval.
- 13) Diversions equipped with a fish screen that utilizes an automated cleaning device will have a minimum effective surface area of 2.5 square feet per cfs, and a nominal maximum approach velocity of 0.4 feet per second (fps).
- 14) Diversions with no automated cleaning device shall have a minimum effective surface area of 5 square foot per cfs, and a nominal maximum approach rate of 0.2 fps; and a round or square screen mesh that is no larger than 2.38 mm (0.094 inch) in the narrow dimension, or any other shape that is no larger than 1.75 mm (0.069 inch) in the narrow dimension.

4.1.4 Category 1c) Headcut and Grade Stabilization

Description

BPA proposes to review and fund the restoration of fish passage and grade control (i.e., headcut stabilization) with geomorphically-appropriate structures constructed from rock or large wood (LW). Boulder weirs and roughened channels may be installed for grade control at culverts to mitigate headcuts, and to provide passage at small dams or other channel obstructions that cannot otherwise be removed. For wood-dominated systems, grade control engineered log jams (ELJs) should be considered as an alternative.

Grade control ELJs are designed to arrest channel downcutting or incision, retain sediment, lower stream energy, and increase water elevations to reconnect floodplain habitat and diffuse downstream flood peaks. Grade control ELJs also serve to protect infrastructure that is exposed

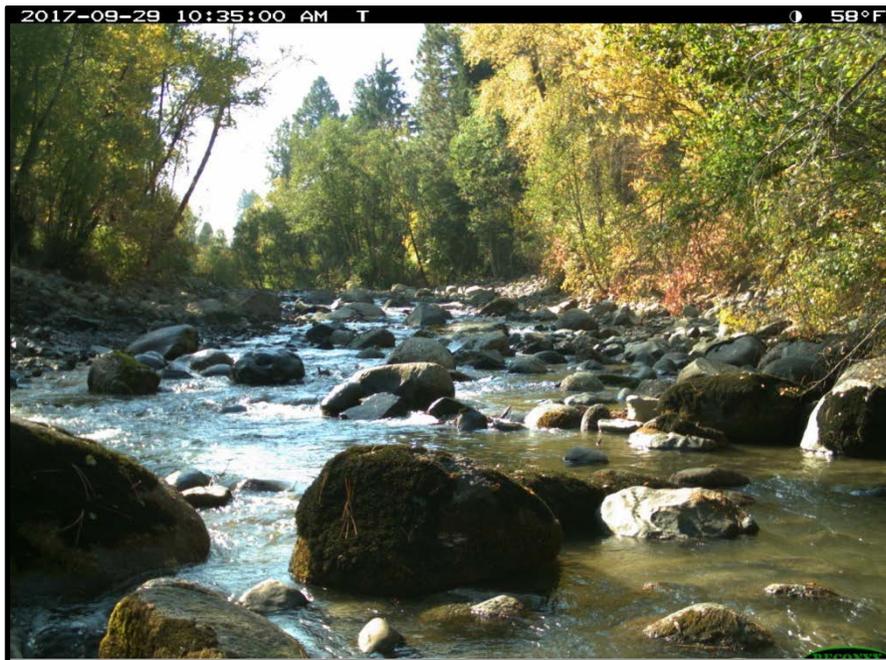
by channel incision and to stabilize over-steepened banks. Unlike hard weirs or rock grade control structures, a grade control ELJ is a complex broad-crested structure that dissipates energy more gradually.

If geomorphic conditions are appropriate, consideration should be given towards use of a roughened channel or constructed riffle to minimize the potential for future development of a passage (jump height) barrier.

Guidelines for Review

- **Low Risk:** Boulder weirs and other grade control structures that address headcuts less than 18 inches in height (18 inches refers to height of the headcut, rather than the height of individual weirs or other grade-control structures intended to address the headcut) with drawings that demonstrate the incorporation of applicable conservation measures.
- **Medium Risk:** Boulder weirs and other grade control structures that are constructed to address headcuts greater than 18 inches in height (elevation differential across headcut from streambed) will require both BPA and NMFS Engineering Review. Roughened channels or constructed riffles are considered medium-risk.

All medium to high risk projects shall address Section 2.5 **Basis of Design Report (BDR)** Requirements on page 16.



Conservation Measures

- 1) For boulder weirs and other grade control structures that are greater than 18 inches in height (elevation differential across headcut from streambed), the profile of the stream

channel thalweg in the design plan shall provide enough information to clearly demonstrate project impacts to the stream channel and the potential for channel degradation, for a minimum for (10) upstream and (10) downstream channel widths of the downstream and upstream boundaries of the project.

- 2) All structures will be designed to the design benchmarks set forth in NMFS 2011¹⁷ (or most recent version).
- 3) **Boulder weirs** shall incorporate the following design features:
 - a) Install boulder weirs low in relation to channel dimensions so that they are completely overtopped during channel-forming flow events (approximately a 1.5-year flow event).
 - b) Boulder weirs are to be placed diagonally across the channel or in upstream pointing “V” or “U” configurations (with the apex oriented upstream). The apex should be lower in elevation than the structure wings to support low flow consolidation.
 - c) 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. This can be accomplished by providing plunges no greater than 6 inches in height, allowing for juvenile fish passage at all flows.
 - d) Key the weirs into the streambed (preferably at least 2.5 times their exposure height)) to minimize structure undermining due to scour. The weir should also be keyed into both banks in a manner that prevents water from cutting around the structure.
 - e) Include fine material in the weir material mix to help seal the weir/channel bed, thereby preventing subsurface flow. Geotextile material can be used as an alternative approach to prevent subsurface flow.
 - f) Rock for boulder weirs shall be durable and of suitable quality to ensure permanence in the climate in which it is to be used.
 - g) Full spanning boulder weir placement shall be coupled with measures to improve habitat complexity (e.g., LW placement, etc.) and protection of riparian areas.
 - h) The use of gabions, cable, or other means to prevent the movement of individual boulders in a boulder weir is not allowed.
- 4) **Headcut stabilization** shall incorporate the following design features:
 - a) Armor the head-cut with sufficiently-sized and amounts of material to prevent continued up-stream movement. Materials can include both rock and organic materials which are native to the area.

¹⁷ NMFS. 2011. Anadromous Salmonid Passage Facility Design. NMFS, Northwest Region, Portland, Oregon. Available at: http://www.westcoast.fisheries.noaa.gov/publications/hydropower/fish_passage_design_criteria.pdf

- b) Focus stabilization efforts in the plunge pool, the head cut, as well as in a short distance of stream above the headcut.
- c) Minimize lateral migration of the channel around the head cut (“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.
- d) Provide fish passage over a stabilized head-cut through a series of log or rock weir structures or a roughened channel.
- e) Headcut stabilization structures will be constructed utilizing stream simulation bed material, which will be pressure-washed into place until surface flow is apparent and minimal subsurface material to ensure fish passage immediately following construction (if natural flows are sufficient). Successful washing will be determined by minimizing voids within placed matrix such that ponding occurs with little to no percolation losses.

4.1.5 Category 1d) Low Flow Consolidation

Description

BPA proposes to fund and review projects that: (a) modify diffused or braided flow conditions that impede fish passage; (b) modify dam aprons with shallow depth (less than 10 inches); or (c) utilize temporary placement of sandbags, straw bales, and ecology blocks to provide depths and velocities passable to upstream migrants.

Guidelines for Review

- **Medium or High Risk:** All of the sub-activities under the Low Flow Consolidation activity category will require both BPA and NMFS Engineering Review.

All medium to high risk projects shall address Section 2.5 **Basis of Design Report (BDR)** Requirements on page 16.

Conservation Measures

- 1) Fish Passage will be designed to the design benchmarks set forth in NMFS 2011 (or most recent version) and, where appropriate, guidelines set forth in Pacific Lamprey Technical Workgroup 2017¹⁸.

¹⁸ *Practical guidelines for incorporating adult Pacific lamprey passage at fishways* (Pacific Lamprey Technical Workgroup 2017) (<https://www.fws.gov/pacificlamprey/mainpage.cfm>)

- 2) All temporary material placed in the stream to aid low-flow fish passage will be removed when stream flow increases, prior to anticipated high flows that could wash consolidation measures away or cause flow to go around them.

4.1.6 Category 1e) Provide Fish Passage at an Existing Facility

Description

BPA proposes to fund and review projects that: (a) re-engineer fish passage or fish collection facilities that are improperly designed; (b) periodic maintenance of fish passage or fish collection facilities to ensure proper functioning (e.g., cleaning debris buildup, replacement of parts); and (c) installation of a fish ladder at an existing facility.

Fish ladders that are primarily designed for salmonids are usually impediments to lamprey passage as they do not have continuous, adequate surfaces for attachment, velocities are often too high, and there are inadequate places for resting. Providing rounded corners, smooth continuous floor for attachment, resting areas, or providing a natural stream channel (stream simulation) or wetted ramp for passage over the impediment have been effective in facilitating lamprey passage.



Guidelines for Review

- **Low Risk:** Periodic Maintenance of Fish passage or Fish Collection Facilities.
- **Medium or High Risk:** Re-engineering improperly-designed fish passage or fish collection facilities, installation of a fish ladder at an existing facility, or other activities that are not considered maintenance. These require BPA and NMFS Engineering Review.
- All medium to high risk projects shall address Section 2.5 **Basis of Design Report** (BDR) Requirements on page 16.

Conservation Measures

- 1) Fish Passage will be designed to the design benchmarks set forth in NMFS 2011¹⁹ (or most recent version).
- 2) Design consideration should be given for Pacific lamprey passage, as described in guidelines set forth in Pacific Lamprey Technical Workgroup 2017²⁰.
- 3) Treated wood and copper- or zinc-plated hardware shall not be used in the construction of fish ladders. Concrete must be sufficiently cured or dried²¹ before coming into contact with stream flow.

4.1.7 Transportation Infrastructure

BPA proposes to review and fund maintenance, removal, or replacement of bridges, culverts, and fords to improve fish passage; prevent streambank and roadbed erosion; facilitate natural sediment and wood movement; and eliminate or reduce excess sediment loading.

4.1.7.1 Category 1f) Bridge and Culvert Removal or Replacement

Description

When replacing an existing culvert with a new crossing, the preferred methods of replacement are (in decreasing order of preference):

- 1) Bridge
- 2) Open bottom culvert (designed by the streambed simulation design method)

¹⁹ NMFS (National Marine Fisheries Service). 2011. Anadromous Salmonid Passage Facility Design. NMFS, Northwest Region, Portland, Oregon. Available at: http://www.westcoast.fisheries.noaa.gov/publications/hydropower/fish_passage_design_criteria.pdf

²⁰ *Practical guidelines for incorporating adult Pacific lamprey passage at fishways* (Pacific Lamprey Technical Workgroup 2017) (<https://www.fws.gov/pacificlamprey/mainpage.cfm>)

²¹ NMFS recommends 48 to 72 hours, depending on temperature.

- 3) Closed bottom culvert (designed by the streambed simulation design method or the no-slope method)

New culverts can only be built when an existing crossing was present.

Guidelines for Review

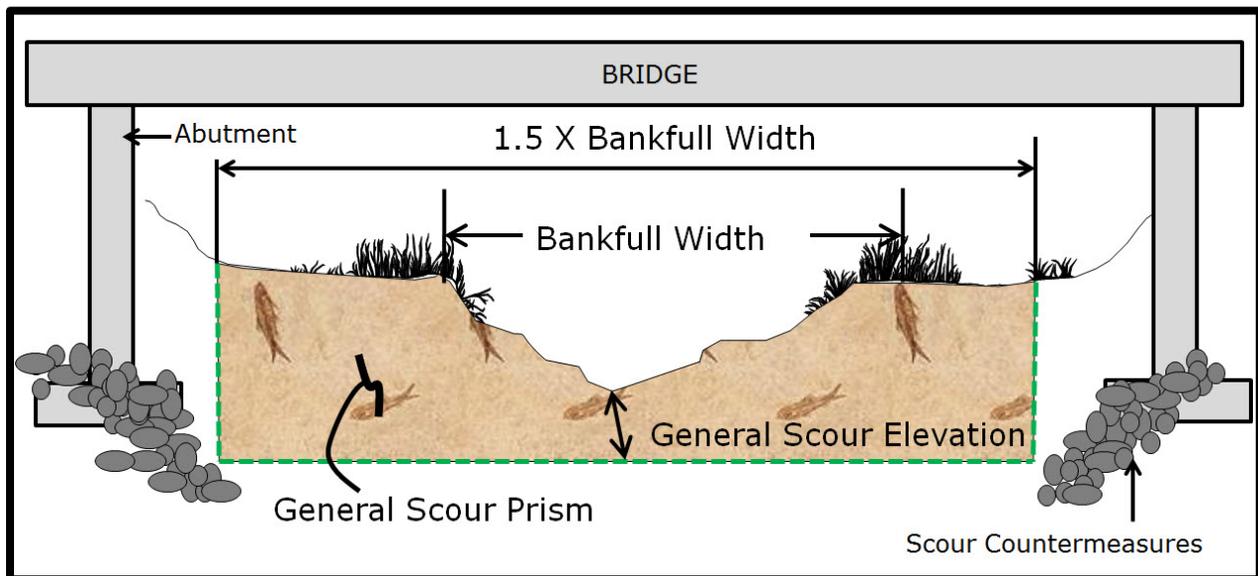
- **Medium Risk:** Culverts and bridges will require BPA Engineering Review.

All medium to high risk projects shall address Section 2.5 **Basis of Design Report (BDR)** Requirements on page 16.

Conservation Measures

- 1) Bridges and open bottom culverts must be designed so they are wide enough to maintain a clear, unobstructed opening during events that approximate a two-year recurrence interval.
 - a) A single span bridge or stream simulation culvert must maintain a clear and unobstructed opening 1.5 times the bankfull width or greater (Figure 2).
 - b) A multiple span bridge must maintain a total clear and unobstructed opening 2.2 times the bankfull width or greater.
 - c) For bridge structures across steep canyons or tidal sloughs, entrenchment ratios (ER) may be used in order to calculate appropriate span (see guidance Figure 3).

Figure 2 Bridge Scour Prism Illustration²²



²² For guidance on how to complete bridge scour and stream stability analysis, refer to page 56 of this document

- 2) Bridge scour and stream stability countermeasures may **not** be applied within the general scour prism (the brown shaded area in Figure 2) and calculate general scour refer to guidance on page 62.
- 3) If relief conduits are necessary, then they should pass through existing fill.
- 4) Remove unused bridge supports down to an elevation below the total scour depth.
- 5) Reshape streambanks in a manner that does not create a velocity that differs from upstream and downstream conditions.
- 6) If the crossing will occur within 300 feet of an active spawning area, only full-span bridges or open bottom culverts utilizing streambed simulation (continuous streambed that simulates natural channel width, depth, and slope connects the reaches up and downstream of the crossing) will be used.
- 7) Closed bottom culverts must be a minimum of 9 feet in diameter to accommodate:
 - a) **Channel Vertical Clearance:** The minimum vertical clearance between the culvert bed and ceiling should be more than 6 feet.
 - b) **Embedment:** If a culvert is used, the bottom of the culvert should be buried into the streambed not less than 30% at the outlet, not more than 50% at the inlet of the culvert height, and to a minimum depth of 3 feet.
- 8) **Channel Slope:** The slope of the reconstructed streambed within the culvert should approximate the average slope of the adjacent stream from approximately ten channel widths upstream and downstream of the site in which it is being placed, or approximate the average slope of an appropriate reference reach that represents natural conditions outside the zone of the road crossing influence.
- 9) **Maximum Length of Road Crossing:** The length for bridges and culverts utilizing the streambed simulation method should be less than 150 feet.
- 10) **Fill Materials:** Fill materials should be comprised of materials of similar size, composition, and mobility to natural bed materials in an appropriate reference reach. Fill material must not be angular rock unless the natural material is angular (e.g. basalt lithology).
- 11) Design plans must include a construction note requirement to wash fines to seal bed properly and prevent flows from going subsurface.
- 12) Structure material must be concrete, metal, or untreated wood. Concrete must be sufficiently cured or dried²³ before coming into contact with stream flow. The use of treated wood for bridge construction or replacement is not allowed.
- 13) Projects in stream channels with gradients above six percent will utilize a bridge or open bottom culvert.
- 14) The minimum culvert width for stream simulation must be 1.5 times the bankfull width.

²³ NMFS recommends 48 to 72 hours, depending on temperature.

- 15) The project sponsor shall include suitable grade controls to prevent culvert failure caused by changes in stream elevation. Grade control structures to prevent headcutting above or below the culvert or bridge may be built using rock or wood as outlined in the **Headcut and Grade Stabilization** criteria under the **Profile Discontinuity** activity subcategory 1c.



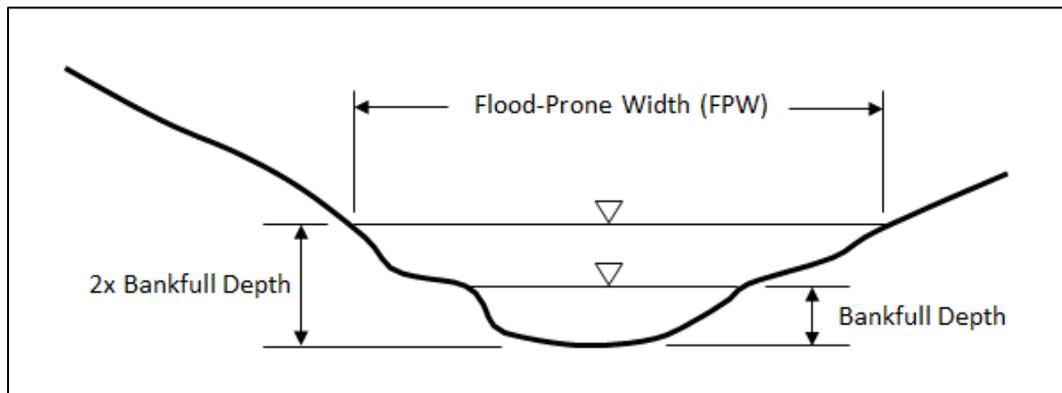
Guidelines for Calculating Entrenchment Ratios

Steep canyons and tidal sloughs often require smaller spans due to limited floodplain connection. If the stream crossing is located in a tidal slough or in a canyon steeper than 5%, the following method may be used to determine bridge and culvert spans.

Calculate the entrenchment ratio (ER) per Rosgen (1994)²⁴.

- ER = flood-prone width (FPW) / bankfull width (BFW)
- FPW is defined as the water surface width at a height of twice the bankfull depth above the bed (Figure 3). The BFW shall be determined at an appropriate reference location not impacted by an existing bridge.

Figure 3 Flood Prone Width and Bankfull Width



For single span structures:

- If ER is greater than 1.5, a minimum opening of 1.5x BFW is required.
- If ER is less than 1.5, the minimum opening shall be equal to the ER, but not less than 1.2x BFW.

For multiple span structures:

- If ER is greater than 2.2, a minimum opening of 2.2x BFW is required.
- If ER is less than 2.2, the minimum opening shall be equal to the ER, but not less than 1.5x BFW.

²⁴ Rosgen, D. L., 1994. A classification of natural rivers. *Catena*, 22, 169-199

Guidelines for Calculating General Scour Elevations

General scour is a lowering of the streambed across the stream or waterway at the crossing. This lowering may be uniform across the bed or non-uniform, that is, the depth of scour may be deeper in some parts of the cross section. The following method shall be the minimum analyses required to determine general scour elevation and, in combination with the 1.5 times bankfull top width, used to establish the general scour prism as presented in Figure 2 above.

Equation #1 is used to determine the flow velocity (V_c) needed to move the streambed material. The bankfull depth (y) is determined from hydraulic model results for the 2-year flood. The computed bankfull depth should be compared against the field measured bankfull depth with the larger of the two values used for (y) in Equation #1. The D_{50} particle size should be defined from the project-reach-specific pebble count.

Equation #1

$$V_c = 11.17y^{1/6}D_{50}^{1/3}$$

V_c = Critical velocity above which bed material of size D and smaller will be transported (ft)

y = Bankfull depth within the proposed culvert or bridge (ft)

D_{50} = Particle for which 50% is finer (ft)

Equation #2 is used to determine the scour depth (d_s) below the streambed elevation. The bankfull depth (y) and the critical velocity (V_c) are taken from Equation #1 above. The mean velocity (V_m) is determined from hydraulic model results for the 2-year flood.

Equation #2

$$d_s = y\left(\frac{V_m}{V_c} - 1\right)$$

d_s = Scour depth below streambed at thalweg (ft)

y = Bankfull depth within the proposed culvert or bridge (ft)

V_c = Critical velocity above which bed material of size D and smaller will be transported (ft)

V_m = Mean velocity within the proposed culvert or bridge (ft)

Results from the scour depth calculation should be compared against observed scour holes or pools within or adjacent to the project reach. Consideration should be also given to evaluating the stream bed mobility upstream and downstream of the proposed crossing. The general scour prism and the proposed stream crossing shall be presented relative to a surveyed cross section of the stream channel and floodplain.

For additional guidance on engineering calculations for all components of bridge and culvert scour analysis, the designer is directed to **Evaluating Scour at Bridges**, Fifth Edition, Hydraulic Engineering Circular No. 18, April 2012, Publication No. FHWA-HIF-12-003, U.S. Department of Transportation Federal Highway Administration.

4.1.7.2 Category 1g) Bridge and Culvert Maintenance

Description

BPA proposes to fund the redress, or return, of a bridge or culvert to its as-built conditions.

Guidelines for Review

- **Low Risk:** Culverts and bridge maintenance is a low-risk activity and requires no review.

Conservation Measures

- 1) Culverts will be cleaned by working from the top of the bank, unless culvert access using work area isolation would result in less habitat disturbance. Only the minimum amount of wood, sediment and other natural debris necessary to maintain culvert function will be removed; spawning gravel will not be disturbed.
- 2) All large wood, cobbles, and gravels recovered during cleaning will be placed downstream of the culvert.
- 3) Do all routine work in the dry. If this is not possible, follow work area isolation criteria outlined in the Work Area Isolation & Fish Salvage Requirements in Section 3.1.2.

4.1.7.3 Category 1h) Installation of Fords

Description

Fords will be installed to allow improved stream crossing conditions only. New fords shall not be installed when there was not a previously existing stream crossing. For the purposes of this proposed action, fords are defined as crossings for vehicles, off-highway vehicles (OHVs), bikes, pack animals, and livestock.

Guidelines for Review

- **Low Risk:** Fords that meet all conservation measures.
- **Medium Risk:** Fords that do not meet all conservation measures. These shall require a review by BPA.

All medium to high risk projects shall address Section 2.5 **Basis of Design Report (BDR)** Requirements on page 16.

Conservation Measures

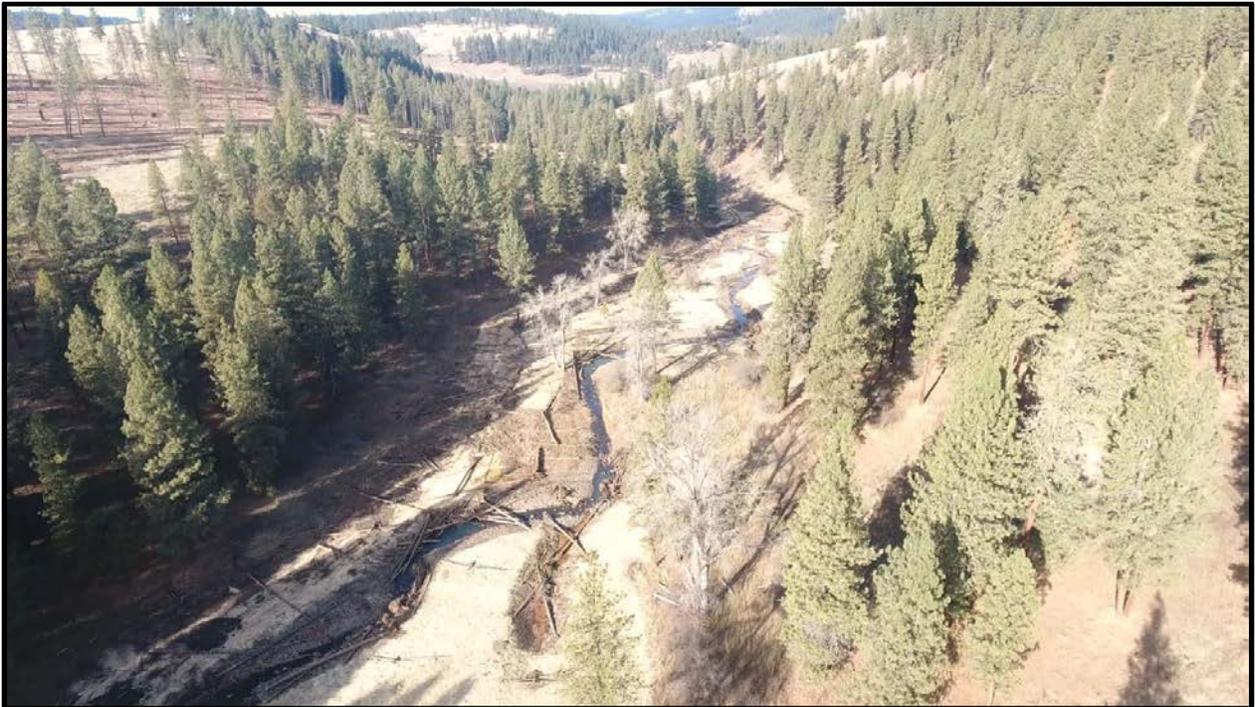
- 1) The ford will not create barriers to the passage of adult and juvenile fish. This includes upstream passage of Pacific lamprey, so any corners should be rounded to allow their passage.
- 2) Ford stream crossings will require the placement of river rock along the stream bottom. The rock shall be of proper-sized gradation for that stream and, if possible, non-angular.
- 3) Existing access roads, trails, and stream crossings will be used whenever possible, unless new construction would result in less habitat disturbance and the old crossing is retired.
- 4) The ford will not be located in an area that will result in disturbance or damage to a properly functioning riparian area.
- 5) Fords will be placed on bedrock or stable substrates whenever possible.
- 6) Fords will not be placed in areas where ESA-listed salmonids (salmon, steelhead, bull trout) spawn or are suspected of spawning; or within 300 feet of such areas if spawning areas may be disturbed. Sufficient information detailing locations of ESA-listed salmonid spawning areas within the reach shall be provided to demonstrate adherence to this conservation measure.
- 7) Bank cuts, if any, will be stabilized with vegetation; and approaches and crossings will be protected with river rock (not crushed rock) when necessary to prevent erosion.
- 8) Fords will have a maximum width of 15 feet (downstream-upstream) to minimize the time that livestock spends in the crossing or riparian area.
- 9) Fences will be installed (if not already existing and functioning) along with all new and replaced fords to limit access of livestock to riparian areas. Fenced-off riparian areas will be maximized in size and planted with native vegetation. Fences will not inhibit upstream or downstream movement of fish or significantly impede bedload movement. Where appropriate, construct fences at fords to allow passage of large wood and other natural debris.
- 10) Vehicle fords will only be allowed in streams with no salmonid fish spawning.
- 11) Designs must demonstrate that the ford accommodates 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.

4.2 Category 2: River, Stream, Floodplain, and Wetland Restoration

BPA proposes to review and fund river, stream, floodplain, and wetland restoration actions with the objective of providing appropriate habitat conditions required for foraging, rearing, and migrating ESA-listed fish.

Projects utilizing habitat restoration actions outlined within this activity category shall be related to limiting factors identified within the applicable sub-basin plan for the watershed, a recovery plan for ESA-listed species, or shall be prioritized by recommended restoration activities identified within a localized region by a technical oversight and steering committee (e.g., the Columbia River Estuary). Individual projects may utilize a combination of the activities listed in the **River, Stream, Floodplain, and Wetland Restoration** activity category.

BPA proposes the following activities to improve fish habitat: (a) improve secondary channel and wetland habitats; (b) set-back or removal of existing berms, dikes, and levees; (c) protect streambanks using bioengineering methods; (d) install habitat-forming natural material instream structures (e.g., large wood, boulders, and spawning gravel); (e) riparian vegetation planting; and (f) channel reconstruction.



4.2.1 Category 2a) Improve Secondary Channel and Floodplain Interactions

Description

BPA proposes to review and fund projects that reconnect historical stream channels within floodplains; restore or modify hydrologic and other essential habitat features of historical river floodplain swales, abandoned side channels, spring-flow channels, wetlands, and historical floodplain channels; and create new self-sustaining side channel habitats, which are maintained through natural processes.



Guidelines for Review

- **Medium or High Risk:** All of the sub-activities under the **Improve Secondary Channel and Wetland Habitats** projects subcategory will require BPA review.

All medium to high risk projects shall address Section 2.5 **Basis of Design Report (BDR)** Requirements on page 16.

Conservation Measures

- 1) Designs must demonstrate that the project will be self-sustaining over time or promote the recovery of natural habitat-forming processes. Self-sustaining means the restored or created habitat would not require major or periodic maintenance, but function naturally within the processes of the floodplain. Promotion of natural habitat-forming processes means an early step in the restoration of a process that may take decades or multiple steps to restore.

- 2) Proposed new side channel construction must be within the historic floodplain (e.g. 5-year recurrence interval), current channel meander migration zone, and require limited excavation for construction. Reconnection of historical fragmented habitats is preferred.
- 3) Perennial side channels will be constructed to prevent fish stranding by providing a continual positive **overall** grade, or, if the gradient is lower than the main channel then by providing a year-round water connection.
- 4) Intermittent side channels activated only at flood stage should be designed with sufficient roughness and gradient to create shallow, slow-moving water that will not attract fish.
- 5) Excavated material removed from off- or side-channel habitat shall be hauled to an upland site or spread across the adjacent floodplain in a manner that does not restrict floodplain capacity. Hydric soils may be salvaged to provide appropriate substrate and/or seed source for hydrophytic plant community development. Hydric soils will only be obtained from wetland salvage sites.
- 6) Excavation depth will never exceed the maximum thalweg depth of the main channel.
- 7) All side channel and pool habitat work will occur in isolation from waters occupied by ESA-listed salmonid species until project completion. During project completion, a reconnection may be made by either excavation to waters occupied by ESA-listed salmonids or re-watering of these channel units.
- 8) Adequate precautions will be taken to prevent the creation of fish passage issues or stranding of juvenile or adult fish. Stranding must be avoided by incorporating floodplain or channel features that create shallow, slow-moving, water during flood stage that will not attract fish.
- 9) **Re-watering stream channels.** For stream channels which have been isolated and dewatered during project construction:
 - a. Reconstructed stream channels will be “pre-washed” into a reach equipped with sediment capture devices, prior to reintroduction of stream flow.
 - b. Stream channels will be re-watered slowly to minimize a sudden increase in turbidity (use **Staged Rewatering Plan** in Section 3.2 when appropriate).

4.2.2 Category 2b) Set-back or Removal of Existing Berms, Dikes, and Levees

Description

This action category includes the removal of fill (e.g., dredge spoils) from past channelization projects, roads, trails, railroad beds, dikes, berms, and levees in order to restore natural estuary and freshwater floodplain functions. Tide gates may be setback with berms, dikes, and levees. However, tide gates must not degrade baseline conditions (fish passage and habitat). Placement of new gates where none previously existed is not covered in this consultation.

Actions in freshwater, estuarine, and marine areas include: 1) full and partial removal of levees, dikes, berms, and jetties; 2) breaching of levees, dikes, and berms; 3) lowering of levees, dikes, and berms; 4) setback of levees, dikes, and berms; and 5) removal of spoils piles from the floodplain.



Guidelines for Review

- **Medium or High Risk:** All of the sub-activities under the **Set-back or Removal of Existing Berms, Dikes, and Levees** projects subcategory will require BPA Engineering review. Tide gates will require NMFS engineering review.

All medium to high risk projects shall address Section 2.5 **Basis of Design** Report (BDR) Requirements on page 16.

Conservation Measures

- 1) To the greatest degree possible, non-native fill material, originating from outside the floodplain of the action area, will be removed from the floodplain and disposed of at an upland site.
- 2) Breaches shall be equal to or greater than the active channel width to reduce the potential for channel avulsion during flood events.
- 3) In addition to other breaches, the berm, dike, or levee shall always be breached at the downstream end of the project and/or at the lowest elevation of the floodplain to ensure that flows will naturally recede back into the main channel, minimizing fish entrapment.
- 4) When necessary, loosen compacted soils once overburden material is removed.
- 5) Overburden or fill material that is native to the project area may be used within the floodplain to create set-back dikes and fill anthropogenic holes provided that this does not impede floodplain function.
- 6) When a setback is required, setback locations should be prioritized to the outside of either the meander belt width or the channel meander zone margins.

4.2.3 Category 2c) Protect Streambanks Using Bioengineering Methods

The HIP will not cover stand-alone bank stabilization projects.

Description

BPA proposes to review and fund projects that restore eroding streambanks through bank shaping; installation of soil reinforcements (e.g., coir logs, large wood, etc.) and other bioengineering techniques, as necessary, to support development of riparian vegetation; and/or planting of trees, shrubs, and herbaceous cover, as necessary, to restore ecological functions in riparian and floodplain habitats.

As actions that are covered by this programmatic consultation need to have the purpose of restoring floodplain and estuary functions or to enhance fish habitat, streambank stabilization shall only be proposed when there are additional interrelated and interdependent habitat restoration actions.

The primary structural streambank protection action proposed is the installation of large wood and riparian vegetation configured to increase bank strength and resistance to erosion. This is considered to be an ecological approach to managing streambank erosion (i.e., bioengineering).

Guidelines for Review

- **Medium or High Risk:** Streambank projects will require BPA Engineering review.

All medium to high risk projects shall address Section 2.5 **Basis of Design Report (BDR)** Requirements on page 16.

Conservation Measures

- 1) Without changing the location of the bank toe, damaged streambanks will be restored to a slope, pattern, and profile suitable for establishment of permanent woody vegetation. This may include sloping of unconsolidated bank material to a stable angle of repose or the use of benches in consolidated cohesive soils. The purpose of bank shaping is to provide a more stable platform for the establishment of riparian vegetation, while also reducing the depth to the water table, therefore promoting better plant survival.
- 2) Projects should ideally use plantings and soil bioengineering for bank stabilization, and use large wood for stabilization as a last resort. The goal of bioengineering projects should be long term stabilization by vegetation.
- 3) Large wood will be added to create habitat complexity and interstitial habitats through use of various large wood sizes and configurations of the placements when feasible.
- 4) Structural placement of large wood should focus on providing channel boundary roughness for energy dissipation versus flow re-direction that may affect the stability of the opposite streambank.
- 5) Large wood will be intact, hard, and undecayed to partly decaying with untrimmed root wads to provide functional refugia habitat for fish. Use of decayed or fragmented wood found lying on the ground may be used for additional roughness and to add complexity to large wood placements but will not constitute the primary structural components.
- 6) Wood that is already within the stream or suspended over the stream may be repositioned to allow for greater interaction with the stream.
- 7) Large wood anchoring will not utilize cable or chain. Manila, sisal or other biodegradable ropes may be used for lashing connections. If hydraulic conditions warrant use of structural connections, then rebar pinning or bolting may be used. The utilization of structural connections should be used minimally and only to ensure structural longevity in highly energetic systems (high gradient systems with lateral confinement and a limited floodplain). The need for structural anchorage shall be demonstrated in the design documentation.
- 8) Rock will not be used for streambank stabilization, except as ballast to stabilize large wood unless it is necessary to prevent scouring or downcutting of an existing flow control structure (e.g., a culvert, bridge support, headwall, utility lines, or building). In this case, rock may be used as the primary structural component for construction of vegetated riprap with large wood. Scour holes may be filled with rock to prevent damage to structural foundations but will not extend above the adjacent bed of the river. This does not include scour protection for bridge approach fills.
- 9) The rock may not impair natural stream flows into or out of secondary channels or riparian wetlands.
- 10) Fencing will be installed as necessary to prevent access and grazing damage to revegetated sites and riparian buffer strips.

- 11) Riparian buffer strips associated with streambank protection shall extend from the bankfull elevation towards the floodplain a minimum distance of 35 feet.



4.2.4 Category 2d) Install Habitat-Forming Instream Structures (Large Wood, Small Wood and Boulders)²⁵

Description

BPA proposes to review and fund projects that include placement of in stream structures comprised of natural habitat-forming materials to provide instream complexity and to support spawning, rearing, and resting habitat for salmonids and other aquatic species. Anthropogenic activities that have altered riparian habitats, such as splash damming and the removal of large wood, logjams, and boulders have reduced instream habitat complexity in many rivers and have eliminated or reduced features like pools, cover, and bed complexity that Salmonids need for rearing, feeding, and migrating. To offset these impacts, in-stream structures consisting of large wood, small wood and boulders will be placed in stream channels either individually or in combination.

Projects utilizing structures shall increase instream structural complexity and diversity, shall mimic the processes and functions of natural input of large wood (e.g., whole conifer and hardwood trees, logs, root wads, etc.); boulders and complex bedforms, create rearing habitat and pool formation; promote spawning gravel deposition; reduce siltation in pools; reduce the

²⁵ descriptions of each technique refer to the WDFW Stream Habitat Restoration Guidelines: <http://wdfw.wa.gov/publications/00046/>, the USACE's EMRRP Technical Notes, Stream Restoration: <http://el.ercdc.usace.army.mil/publications.cfm?Topic=technote&Code=emrrp>, or the NRCS National Engineering Handbook Part 654, Stream Restoration: <http://policy.nrcs.usda.gov/viewerFS.aspx?id=3491>

width/depth ratio of the stream; decrease flow velocities; deflect flows into adjoining floodplain areas to increase channel and floodplain function, promote natural vegetation composition and diversity on the floodplain and provide high-flow refugia.

The term “structure” refers to any intentionally placed object in the stream or floodplain.

Structures that come in contact with water obstruct streamflow and force it to run over, around, and/or under the structure. This redirection, concentration, or expansion of flow influences the form, structure, hydraulics, and consequently, the function of the stream. As a result, instream structures are prone to having unintended consequences; caution must be exercised when using this approach.

All structures placed in a channel have the potential to affect channel hydraulics, sediment scour and deposition patterns, and the processes of wood and sediment transport. The degree to which these effects achieve the desired results or place nearby habitat, infrastructure, property, and public safety at risk depends on a number of important variables that affect the way in which a structure functions in the stream. The following parameters should be considered in structure design.

- Channel constriction caused by the structure
- Location of the structure within the channel cross-section and its height relative to the depth of flow
- Structure spacing
- Structure configuration and position in the channel
- Sediment supply and substrate composition
- Wood loading, transport and supply
- Channel confinement
- Channel slope
- Hydrology
- Fisheries life histories and limiting factors
- Time



Large Wood Placements

Large wood placements are defined herein as projects or structures that use trees that are greater 1 foot in diameter as measured at diameter at breast height, (DBH), (measured 4.5 feet from the end of the rootwad or cut end) and 15 feet or greater in length as the primary pieces within the placement or structure. This criterion does not preclude the use of materials with dimensions less than this size class for racking, woven, or slash that may be incorporated into the structure.

Placement of large woody debris (wood) and other structures in streams is one of the most widespread and common techniques to improve riverine fish habitat. Techniques for wood placement range from simply falling, pushing, or hauling trees from the riparian zone into the active stream channel to construction of highly engineered structures such as log weirs or engineered logjams (Roni et al. 2014).

Large wood will be placed to increase coarse sediment storage, increase habitat diversity and complexity, retain gravel for spawning habitat, improve flow heterogeneity, provide long-term nutrient storage and substrate for aquatic macroinvertebrates, moderate flow disturbances, increase retention of leaf litter, and provide refugia for fish during high flows. Structure design criteria should be focused on balancing biological benefit, structural resiliency, and enhancing - complementing watershed driven and reach scale processes. Increasing the system-wide placement and longitudinal extent of process forming friction elements may be more effective in many reaches than individual, large scale structures. This process allows for longitudinal moderation of applied energy along a longer reach of the river system vs. a few large structures that must withstand the applied forces of the simplified watershed and stream network. The placement of large wood should be viewed as an interim solution - a short-term improvement providing habitat as natural rates of woody debris recruitment are restored through riparian forest regeneration.

Habitat created by structures may be critical at specific times of year or ranges of discharge. Therefore, it may be appropriate to establish design discharges that relate to specific fish and wildlife benefits, in addition to those that dictate structural failure. For instance, the limiting factor for fish may be cover during summer low flow or shelter during high flow events. Under these circumstances structures will need to be designed to function during this critical time, at a minimum, in order to optimize their effects. Timing and discharge requirements may be specific to the stream and target species and age class (e.g., fish passage requirements for adult chum salmon will differ from that for juvenile coho salmon).



Small Wood Placements

Small wood placements are defined herein as projects or structures that use trees that are less than 1 foot in diameter as measured at diameter at breast height, (DBH), (measured 4.5 feet from the end of the rootwad or cut end) and 15 feet or less in length.

This activity includes the installation of small wood in-channel structures that mimic the processes and functions of beaver dams including flattening of local stream gradients, increasing interactions between the stream and floodplain, increasing bank storage, capturing of relatively fine sediment in the channel, pool formation, and hyporheic exchange. Structures consist of porous channel-spanning or partial spanning structures comprised of small diameter woody debris (including whole trees) riparian cuttings and other inert materials that are structurally reinforced with small diameter driven posts. Structures include spaces between posts that allow water, sediment, fish, and other aquatic organisms to move through the structure.

Variation of this restoration treatment may include small, whole tree placement, beaver dam analogues, post assisted log structures, post lines only, post lines with wicker weaves, construction of starter dams, reinforcement of existing active beaver dams, and reinforcement of abandoned beaver dams as described by Pollock et al. (2012). The structure (either alone or in combination with debris that it traps) causes a significant reduction in channel cross-sectional area or in series will collectively increase the hydraulic roughness of the channel, thereby reducing velocities, increasing flow depth and creating backwater. The effects of large-scale backwatering can include increased flood levels and frequency of floodplain inundation, potential change in riparian species composition and distribution in response to changing inundation patterns and water table elevations, and reduced reach transport of sediment and woody debris.



Boulder Placements

Boulder placements may be used to restore habitat diversity to plane bed streams from which boulders have been removed, as an enhancement technique to increase habitat diversity in new channels, naturally plane bed stream reaches, and altered plane bed channels that were historically dominated by wood. Boulder placements increase habitat diversity and complexity, improve flow heterogeneity, provide substrate for aquatic vertebrates, moderate flow disturbances, and provide refuge for fish during high flows.

The placement of individual large boulders and boulder clusters to increase structural diversity is important to provide holding and rearing habitat for ESA-listed salmonids and create a diversity of water depth, substrate, and velocity, thereby increasing habitat diversity of an otherwise plane bed stream. Increased diversity is evident immediately after boulder placement and improves over time as substrate is scoured and sorted during high flow events. Boulder clusters should only be applied where a biologic or geomorphic need has been identified.

Guidelines for Review:

Both Large Wood and Small Wood projects shall address the **Basis of Design Requirements** in Section 2.5 **Basis of Design** Report (BDR) Requirements on page 16 and require initial **BPA Engineering Review**.

- **Low Risk:** Installation of habitat forming structures with drawings that demonstrate the incorporation of all conservation measures and require no ballast,

boulders, excavation or structural connections and include no risk to downstream infrastructure or property.

- **Medium or High Risk:** Installation of habitat forming structures that require ballast, excavation, or structural connections. Risk level of habitat forming structures also depends on scope and scale of proposal.

Conservation Measures (Large Wood):

- 1) Large wood placements must be designed to mimic the process and function of natural accumulations of large wood in the channel, estuary, or marine environment and address defined limiting factors.
- 2) Large wood placements for other purposes than habitat restoration or enhancement are excluded from this consultation.
- 3) Large wood must be intact, hard, and undecayed to partly decaying and should preferably include untrimmed root wads when available to provide functional refugia habitat for fish. Large wood includes whole trees with rootwad and limbs attached, pieces of trees with or without rootwads and limbs, and cut logs. Use of decayed or fragmented wood found lying on the ground or partially sunken in the ground is not acceptable for key pieces but may be incorporated to add habitat complexity.
- 4) Large wood anchoring will not utilize cable or chain. Manila, sisal or other biodegradable ropes may be used for lashing connections. If hydraulic conditions warrant use of structural connections then rebar pinning²⁶ or bolting may be used. The utilization of structural connections should be used minimally and only to ensure structural longevity in highly energetic systems (high gradient systems with lateral confinement and limited floodplain). Rationale for structural anchorage shall be justified and demonstrated in the Basis of Design Report and will be evaluated as a component of the HIP Technical Review.
- 5) If 100 year flood design criteria is applied to specific structures then stability requirements must be considered for the primary LWD elements including base, key and anchorage members (logs larger than 15 feet long and greater than one foot in diameter). These pieces are assumed to comprise ~ 50% of the overall structure. Woven, racking, matrix, and recruited material are expected to be transient and dynamically interact with the fluvial system. If specific stability evaluation of a structure result in criteria more conservative than that presented above, then a risk – benefit analyses is expected to ascertain the appropriateness of the subject structure. This assessment will be used to determine the benefits to fish habitat and may result in forgoing or modification of the project element.
- 6) Rock may be used for ballast but should be limited to what is needed to anchor the large wood.

²⁶ If rebar is to be used, the protruding ends should be cut flush with the log or bent in order to prevent impaling fish, people or wildlife.

- 7) Piling shall consist of wood piles; steel piles are not to be used under any circumstance. Drive each piling as follows to minimize the use of force and resulting sound pressure
 - a) Use a vibratory head to drive the piles; an impact hammer shall not be used
 - b) Select areas with soft substrate rather than rocky hard substrate; avoid bedrock
 - c) Isolate the work area if possible to minimize acoustic disturbance

Conservation Measures (Small Wood):

- 1) Small wood placements shall be constructed for floodplain reconnection in stream systems less than 4% stream gradient.
- 2) Structures that are overtopped shall have crest elevations that extend no more than 3 feet above the stream bed. Vertical posts (if utilized) shall be cut flush and not extend above the proposed crest elevation.
- 3) For incised channels, an adaptive management approach using lower elevation structures that trap sediment and aggrade the channel, with future and subsequent project phases is preferred over tall structures with excessive drop and increased risk of failure.
- 4) Vertical posts (if utilized) must be driven to a depth at least 1.5 times the expected scour depth of the waterway or a ratio of 1:2 for exposed – embedded length whichever is more conservative. A minimum 1.5 foot clear space is required between posts.
- 5) All in-stream construction associated with small wood structures shall be completed by hand or small machinery not to exceed 15,000lbs operating weight.
- 6) All primary materials used in small wood placements must consist of non- treated wood (e.g. fence posts) and must be constructed from a materials source collected outside the riparian area.
- 7) Structures cannot unreasonably interfere with use of the waterway for navigation, fishing or recreation.
- 8) Placement of inorganic material is limited to the minimum quantity necessary to prevent under-scour of structure and manage pore flow sufficient to ensure adequate over-topping flow and side flow to facilitate fish passage where required.
- 9) In addition to any other design parameters necessary to meet fish passage requirements, structures must be porous, must provide for a water surface differential of no more than one-foot at low flows, or otherwise provide a clear path for fish passage over, through or around the structure during low flows.
- 10) No cabling, wire, mortar or other materials that serve to affix the structure to the bed, banks or upland is allowed.
- 11) Additional potential effects of these structures may include channel aggradation and associated channel widening, bank erosion, increased channel meandering, and decreased channel depth. The Basis of Design Report must demonstrate how these potential impacts have been addressed.
- 12) At project completion, all disturbed areas, including staging and access areas, will need to be graded smooth, seeded, and planted to repair damage and restore the riparian zone.

Conservation Measures (Boulder Placement):

- 1) Boulder placements for purposes other than habitat restoration or enhancement are not covered under this activity of HIP 4.
- 2) Boulder placements will be limited to reaches with a streambed that consists predominantly of coarse gravel or larger sediments and will address identified limiting factors.
- 3) The cross-sectional area of boulder placements may not exceed 25% of the cross-sectional area of the low-flow channel.
- 4) Boulder placements may not be installed with the purpose of shifting the stream flow to a single flow pattern in the middle or to the side of the stream.
- 5) Boulders will be machine-placed (no end dumping allowed) and will rely on the size of boulder, rather than anchoring, for stability.
- 6) Boulders will be installed in a low position in relation to channel dimensions so that they are completely overtopped during channel-forming flow events (approximately a 2-year flow event).
- 7) At project completion, all disturbed areas, including staging and access areas, will need to be graded smooth, seeded, and planted to repair damage and restore the riparian zone.

4.2.5 Category 2e) Riparian and Wetland Vegetation Planting***Description***

BPA proposes to fund vegetation planting to recover watershed processes and functions associated with native plant communities and that will help restore natural plant species composition and structure. Under this activity category, the project sponsors would plant trees, shrubs, herbaceous plants, and aquatic macrophytes to help stabilize soils or restore riparian plant communities. Large trees such as cottonwoods and conifers will be planted in areas where they historically occurred but are currently either scarce or absent. Native plant species and seeds will be obtained from local sources to ensure plants are adapted to local climate and soil chemistry.

Vegetation management strategies will be utilized that are consistent with local native succession and disturbance regimes and specify seed/plant source, seed/plant mixes, and soil preparation. Planting will address the abiotic factors contributing to the sites' succession (i.e., weather and disturbance patterns, nutrient cycling, and hydrologic condition). Only certified noxious weed-free seed (99.9%), straw, mulch or other vegetation material for site stability and revegetation projects will be utilized.

Guidelines for Review

- **Low Risk:** Riparian vegetation planting is considered low-risk and requires no BPA review.

Conservation Measures

- 1) An experienced silviculturist, botanist, ecologist, or associated technician shall be involved in designing vegetation treatments.
- 2) Species to be planted must be of the same species that naturally occur in the project area.
- 3) Tree and shrub species as well as sedge and rush mats to be used as transplant material shall come from outside the bankfull width, typically in abandoned floodplains, and where such plants are abundant, or be salvaged from areas where excavation is planned.
- 4) Sedge and rush mats should be sized and anchored to prevent their movement during high flow events.
- 5) Species distribution shall mimic natural distribution in the riparian and floodplain areas.



4.2.6 Category 2f) Channel Reconstruction

Description

BPA proposes to review and fund channel reconstruction projects 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. All this will be accomplished by reconstructing stream channels and floodplains that are compatible within the appropriate watershed context and geomorphic setting.

The reconstructed stream system shall be composed of a naturally sustainable and dynamic planform, cross-section, and longitudinal profile which incorporates unimpeded passage and temporary storage of water, sediment, organic material, and species. Stream channel adjustment over time is to be expected in naturally dynamic systems and is a necessary component to restore a wide array of stream functions. It is expected that for most projects there will be a primary channel with secondary channels that are activated at various flow levels to increase floodplain connectivity and to improve aquatic habitat through a range of flows. This proposed action is not intended to artificially stabilize streams into a single location or into a single channel for the purposes of protecting infrastructure or property.

Channel reconstruction consists of re-meandering or movement of the primary active channel and may include structural elements such as streambed simulation materials, streambank restoration, and hydraulic roughness elements. 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. Material selection (large wood, rock, gravel) shall also mimic natural stream system materials.

Guidelines for Review

- **Medium Risk:** Channel Reconstruction that restores historical alignment with minimal excavation shall require BPA HIP Review.
- **High Risk:** Channel Reconstruction that creates entirely new channel meanders through significant excavation shall require BPA Engineering and Interagency Review.

All medium to high risk projects shall address Section 2.5 **Basis of Design** Report (BDR) Requirements on page 16.

Channel Reconstruction also requires a **Staged Rewatering Plan** (Section 3.2) and a **Monitoring and Adaptive Management Plan**

Conservation Measures

- 1) Detailed construction drawings must be provided.
- 2) Designs must demonstrate that channel reconstruction will identify, correct (to the extent possible), and account for (in the project development process), the conditions that lead to the degraded condition.
- 3) Designs must demonstrate that the proposed action will mimic natural conditions for gradient, width, sinuosity and other hydraulic parameters.
- 4) Designs must demonstrate that structural elements shall fit within the geomorphic context of the stream system.
- 5) Designs must demonstrate sufficient hydrology and that the project will be self-sustaining over time. Self-sustaining means the restored or created habitat would not require major or periodic maintenance but function naturally within the processes of the floodplain.
- 6) Designs must demonstrate that the proposed action will not result in the creation of fish passage issues or post-construction stranding of juvenile or adult fish.



4.2.7 Category 2g) Install Habitat-Forming Natural Materials (Sediment and Gravel).

Description

In areas where natural gravel and sediment supplies are low (e.g., immediately below reservoirs), gravel and sediment placement can be used to improve spawning habitat.

Sediment supply is limited in the estuary due to the presence of numerous dams in the Columbia basin that trap sediments and prevent them from depositing downriver. The Columbia River Estuary ESA Recovery Plan Module for Salmon and Steelhead (NMFS 2011) identifies sediment as a limiting factor for salmonid recovery: “The transport of sediment is fundamental to habitat-forming processes in the estuary through sediment deposition and erosion (Fresh et al. 2005). Since the late nineteenth century, sediment transport from the interior basin to the Columbia River estuary has decreased about 60 percent and total sediment transport has decreased about 70 percent (Jay and Kukulka 2003). This reduction in the amount of sediment transport in the Columbia River has affected habitat-forming processes in the estuary (Bottom et al. 2005). It is presumed to be a limiting factor for salmon and steelhead because it limits the accretion of sediment and thus the formation of shallow-water habitats.” Shallow-water habitats are of particular importance to out-migrating juvenile salmonids, in particular young-of-the-year Chinook and chum, which are highly shoreline dependent.

NMFS 2001 states further, “Although the consequences of the reduced transport of sediment through the estuary and plume are not fully understood, the magnitude of change is very large compared to historical benchmarks (Fresh et al. 2005). Sediment also provides important nutrients that support food production in the estuary and plume. Microdetrital food particles adhere to sediment suspended in the water column, making different food sources available to different species than was the case historically. Currently, organic matter associated with fine sediments supplies the majority of estuarine secondary productivity in the food web (Simenstad et al. 1984 as cited in Northwest Power and Conservation Council 2004).”

Sediment will be placed along shorelines to create shallow-water habitat to compensate for loss of natural sediment and concurrent diminishment of migratory habitat and food-web support. This treatment will be used only in areas when fine sediment and/or shallow-water habitat have been identified as a limiting factor in a sub-basin report.

Guidelines for Review

- ***Low - Medium Risk:*** All sediment & gravel placement shall require an initial HIP review and a preliminary sediment evaluation. The HIP review will confirm conservation measures are met and determine if a low-risk rating is appropriate.

All medium to high risk projects shall address Section 2.5 **Basis of Design Report (BDR)** Requirements on page 16.

Conservation Measures (Sediment & Spawning Gravel)

- 4) Augmentation will only occur in areas where the natural supply has been eliminated, significantly reduced through anthropogenic disruptions, or used to initiate gravel accumulations or habitat forming processes in conjunction with other projects, such as simulated log jams and debris flows. Placement of materials for any other purposes besides habitat restoration or enhancement is excluded from this consultation
- 5) Gravel to be placed in streams shall be a properly sized gradation for that stream, clean alluvium with similar angularity as the natural bed material. When possible, use gravel of the same lithology as found in the watershed. Imported gravel must be free of invasive species and non-native seeds.
- 6) Sediment must be sized appropriately for the action area based on information gathered from a reference reach and must be free of invasive species and non-native seeds.
- 7) Designs (or basis of design report) must demonstrate that shallow-water habitat is a limiting factor to salmonid production in the action area for placement of finer materials.
- 8) Sediment source shall be from previously dredged material. However, HIP does not cover dredging that specifically takes place to source the material.
- 9) After placement of gravel or sediment in areas accessible to higher streamflow, allow the stream to naturally sort and distribute the material.
- 10) Do not place gravel directly on bars and riffles that are known spawning areas, which may cause fish to spawn on the unsorted and unstable gravel, thus potentially resulting in redd destruction.
- 11) Spawning gravel or sediment to be placed instream must be obtained from an upland source outside of the channel and riparian area and a properly-sized gradation for that stream, clean, and if possible, non-angular.



4.3 Category 3: Invasive Plant Control.

4.3.1 Category 3a: Manage Vegetation Using Physical Control

Description

BPA proposes to use two mechanisms for vegetation management by physical control in fluvial and estuarine systems: (a) Manual control includes hand pulling and grubbing with hand tools; bagging plant residue for burning or other proper disposal; mulching with organic materials; shading or covering unwanted vegetation; controlling brush and pruning using hand and power tools such as chain saws and machetes; using grazing goats. (b) Mechanical control includes techniques such as mowing, tilling, disking, or plowing. Mechanical control may be carried out over large areas or be confined to smaller areas (known as scalping). For the HIP, upland areas are considered to be 300 feet from bankful width.

Conservation Measures

- 1) Ground-disturbing mechanical activity will be restricted in established buffer zones adjacent to streams, lakes, ponds, wetlands and other identified sensitive habitats based on percent slope. For slopes less than 20%, a buffer width of 35 feet will be used. For slopes over 20%, no ground-disturbing mechanical equipment will be used.
- 2) When possible, manual control (e.g., hand pulling, grubbing, and cutting) will be used in sensitive areas to avoid adverse effects to listed species or water quality.
- 3) All noxious weed material will be disposed of in a manner that will prevent its spread. Noxious weeds that have developed seeds will be bagged and burned.



4.3.2 Category 3b: Manage Vegetation Using Herbicides (River Systems)

Description

BPA proposes to fund management of vegetation using chemical herbicides to recover watershed processes and functions associated with native plant communities in fluvial systems.

Herbicides will be applied in liquid or granular form using wand or boom sprayers mounted on or towed by trucks, ATVs, UTVs, backpack equipment containing a pressurized container with an agitation device, injection, hand wicking cut surfaces, and ground application of granular formulas.

Aerial treatment is not proposed to be covered under this consultation.

Conservation Measures

- 1) **Herbicide applicator qualifications.** Herbicides will be applied only by an appropriately licensed applicator using an herbicide specifically targeted for a particular plant species that will cause the least impact to non-target species. The applicator will be responsible for preparing and carrying out the herbicide transportation and safety plan shown below.
- 2) **Herbicide transportation and safety plan.** The applicator will prepare and carry out an herbicide safety/spill response plan to reduce the likelihood of spills or misapplication, take remedial actions in the event of spills, and fully report the event. At a minimum, the plan will:
 - a) Address spill prevention and containment;
 - b) Estimate and limit the daily quantity of herbicides to be transported to treatment sites;
 - c) Require that impervious material be placed beneath mixing areas in such a manner as to contain small spills associated with mixing/refilling;
 - d) Require a spill cleanup kit be readily available for herbicide transportation, storage and application;
 - e) Outline reporting procedures, including reporting spills to the appropriate regulatory agency;
 - f) Require that equipment used in herbicide storage, transportation, and handling are maintained in a leak proof condition;
 - g) Address transportation routes so that hazardous conditions are avoided to the extent possible;
 - h) Specify mixing and loading locations away from waterbodies so that accidental spills do not contaminate surface waters;
 - i) Require that spray tanks be mixed or washed further than 150 feet of surface water;
 - j) Ensure safe disposal of herbicide containers;

- k) Identify sites that may only be reached by water travel and limit the amount of herbicide that may be transported by watercraft; and
 - l) Instruct all individuals involved, including any contracted applicators, on the plan.
- 3) **Herbicides.** BPA proposes to use the herbicides in Table 3 in the typical application rates for invasive plant control.

Table 3 Allowable Herbicides under HIP

Active Ingredient	Typical Products	Maximum Label Application Rate (ai/ac)
2,4-D (amine)	Amine 4 [®] Weedar 64 [®] Riverdale AM-40 [®]	4.0 lbs
Aminopyralid	Milestone [®]	0.375 lb
Chlorsulfuron	Telar XP [®]	3.0 oz
Clethodim	Select [®]	0.50 lb
Clopyralid	Transline [®]	0.5 lb
Dicamba	Banvel [®] Vanquish [®]	8.0 lbs
Glyphosate	Rodeo [®] Glypro [®] Accord [®] Aquamaster [®] Aquaneat [®] Foresters [®]	3.75 lbs
Imazapic	Plateau [®]	0.189 lb
Imazapyr	Habitat [®] Arsenal [®] Chopper [®]	1.5 lbs
Metsulfuron methyl	Escort XP [®]	4.0 oz
Picloram	Tordon 22K [®] Tordon K [®]	1 lb
Sethoxydim	Poast [®] Vantage [®]	0.375 lb
Sulfometuron methyl	Oust XP [®]	2.25 oz
Triclopyr (TEA)	Garlon 3A [®] Tahoe 3A [®] Triclopyr 3A [®] Triclopyr 3SL [®]	9.0 lbs

Active Ingredient	Typical Products	Maximum Label Application Rate (ai/ac)
Fluroxypyr (upland only)	Vista®	20 oz (upland only)

- a) **2,4-D.** As a result of the national consultation on herbicides²⁷, this herbicide shall comply with all relevant reasonable and prudent alternatives from the 2011 Biological Opinion (NMFS 2011a):
 - b) Do not apply when wind speeds are below 2 mph or exceed 10 mph, except when winds in excess of 10 mph will carry drift away from salmonid-bearing waters.
 - c) Do not apply when a precipitation event, likely to produce direct runoff to salmonid bearing waters from the treated area, is forecasted by NOAA/NWS (National Weather Service) or other similar forecasting service within 48 hours following application.
- 4) **Adjuvants.** BPA proposes to use the adjuvants in Table 4 in the typical application rates for invasive plant control.

Table 4 Allowable Adjuvants under HIP

Adjuvant Type	Trade Name
Colorants	Dynamark™ U.V. (red)
	Aquamark™ Blue
	Dynamark™ U.V. (blu)
	Hi-Light® (blu)
Surfactants	Activator 90®
	Agri-Dex®
	Bond®
	Bronc-Max®
	Competitor®
Class Act®	

²⁷ On June 30, 2011, NMFS issued a final BiOp, addressing the effects of this herbicide on ESA-listed Pacific salmonids. The BiOp has concluded that EPA’s proposed registration of certain uses of 2,4-D, including aquatic uses of 2,4-D BEE are likely to jeopardize the continued existence of the 28 endangered and threatened Pacific salmonids. <http://www.nmfs.noaa.gov/pr/consultation/pesticides.htm>

Adjuvant Type	Trade Name
	Entry II [®]
	Hasten [®]
	LI 700 [®]
	Liberate [®]
	R-11 [®]
	Super Spread MSO [®]
	Syl-Tac [®]
Drift Retardants	41-A [®]
	Valid [®]
	Compadre [®]

- 5) Polyethoxylated tallow amine (POEA) surfactant and herbicides that contain POEA (e.g., Roundup[®]) are not allowed for use.
- 6) **Herbicide carriers.** Herbicide carriers (solvents) are limited to water or specifically labeled vegetable oil.
- 7) **Herbicide mixing.** Herbicides will be mixed more than 150 feet from any natural waterbody to minimize the risk of an accidental discharge and no more than three different herbicides may be mixed for any one application.
- 8) **Herbicide application methods.** Liquid or granular forms of herbicides to be applied by a licensed applicator as follows:
 - a) **Broadcast spraying** – hand held nozzles attached to back pack tanks or vehicles, or vehicle-mounted booms;
 - b) **Spot spraying** – hand-held nozzles attached to backpack tanks or vehicles, hand-pumped spray, or squirt bottles to spray herbicide directly onto small patches or individual plants;
 - c) **Hand/selective** – wicking and wiping, basal bark, fill (“hack and squirt”), stem injection, and cut-stump.
- 9) **Emergent Knotweed Application.** No aquatic application of chemicals is covered by this consultation except for treating emergent knotweed. Only aquatic labeled glyphosate formulations will be used. The only application methods for emergent knotweed are stem injection (formulation up to 100% for emergent stems greater than 0.75 inches in diameter), wicking or wiping (diluted to 50% formulation), and hand-held spray bottle application of glyphosate (up to the percentage allowed by label instructions when applied to foliage using low-pressure hand-held spot spray applicators).
- 10) **Water Transportation.** Most knotweed patches are expected to have overland access; however, some sites may be reached only by water travel (e.g., wading, inflatable raft,

kayak, etc.). The following measures will be used to reduce the risk of a spill during water transport:

- a) No more than 2.5 gallons of glyphosate will be transported per person or raft, and typically, it will be 1 gallon or less.
- b) Glyphosate will be carried in 1 gallon or smaller plastic containers. The containers will be wrapped in plastic bags and then sealed in a dry-bag. If transported by raft, the dry-bag will be secured to the watercraft.

11) **Minimization of herbicide drift and leaching.** Herbicide drift and leaching will be minimized as follows:

- a) Do not spray when wind speeds exceed 10 mph or are less than 2 mph;
- b) Be aware of wind directions and potential for herbicides to affect aquatic habitat area downwind;
- c) Keep boom or spray as low as possible to reduce wind effects;
- d) Increase spray droplet size whenever possible by decreasing spray pressure, using high flow rate nozzles, using water diluents instead of oil, and adding thickening agents;
- e) Do not apply herbicides during temperature inversions, or when ground temperatures exceed 80 degrees Fahrenheit;
- f) Do not spray when rain, fog or other precipitation is falling or is imminent. Wind and other weather data will be monitored and reported for all broadcast applications. Table 5 identifies BPA's proposed minimum weather and wind speed restrictions (to be used in the absence of more stringent label instructions and restrictions).
- g) During application, applicators will monitor weather conditions hourly at sites where spray methods are being used.

Table 5 Required Herbicide Buffer Widths (from Bankfull Elevation) and Maximum/Minimum Wind Speeds (Mph)

Active Ingredient	Broadcast Application ²⁸		Backpack Sprayer/Bottle ²⁹ Spot Spray Foliar/Basal		Hand Application ³⁰ Wicking/ Wiping/ Injection
	Min buffer (ft.)	Max/ Min wind speed (mph)	Min buffer (ft.)	Max/ Min wind speed (mph)	Min buffer (ft.)
2,4-D (amine)	100	10/2	50	5/2	15
Aminopyralid	100	10/2	15	5/2	0
Chlorsulfuron	100	10/2	15	5/2	0
Clethodim	Not Allowed	Not Allowed	50	5/2	50
Clopyralid	100	10/2	15	5/2	0
Dicamba	100	10/2	15	5/2	0
Glyphosate (aquatic)	100	10/2	15	5/2	0
Glyphosate	100	10/2	100	5/2	100
Imazapic	100	10/2	15	5/2	0
Imazapyr	100	10/2	15	5/2	0
Metsulfuron	100	10/2	15	5/2	0
Picloram	100	8/2	100	5/2	100
Sethoxydim	100	10/2	50	5/2	50
Sulfometuron	100	10/2	15	5/2	0
Triclopyr (TEA)	Not Allowed	Not Allowed	50	5/2	0 for cut-stump application; 15 feet for other applications
Fluroxypyr	300	10/2	300	5/2	300
Herbicide Mixtures	100	Most conservative herbicides	15	Most conservative of herbicides	Most conservative of listed herbicides

²⁸ Ground-based only broadcast application methods via truck/ATV with motorized low-pressure, high-volume sprayers using spray guns, broadcast nozzles, or booms

²⁹ Spot and localized foliar and basal/stump applications using a hand-pump backpack sprayer or field-mixed or pre-mixed hand-operated spray bottle

³⁰ Hand applications to a specific portion of the target plant using wicking, wiping, or injection techniques; herbicides do not touch the soil during the application process

12) ESA-Listed Terrestrial Species. On sites where ESA-listed **terrestrial wildlife** may occur (within 1 mile of habitat where ESA-listed terrestrial wildlife occur), herbicide use will be limited to the chemicals and application rates as shown in Table 6 below. Staff will avoid any potential for direct spraying of wildlife, or immediate habitat in use by wildlife for breeding, feeding, or sheltering.

Table 6 Maximum Application Rates (per discrete application) within 1 Mile of Habitat where ESA-listed Terrestrial Species Occur (lb./ac).

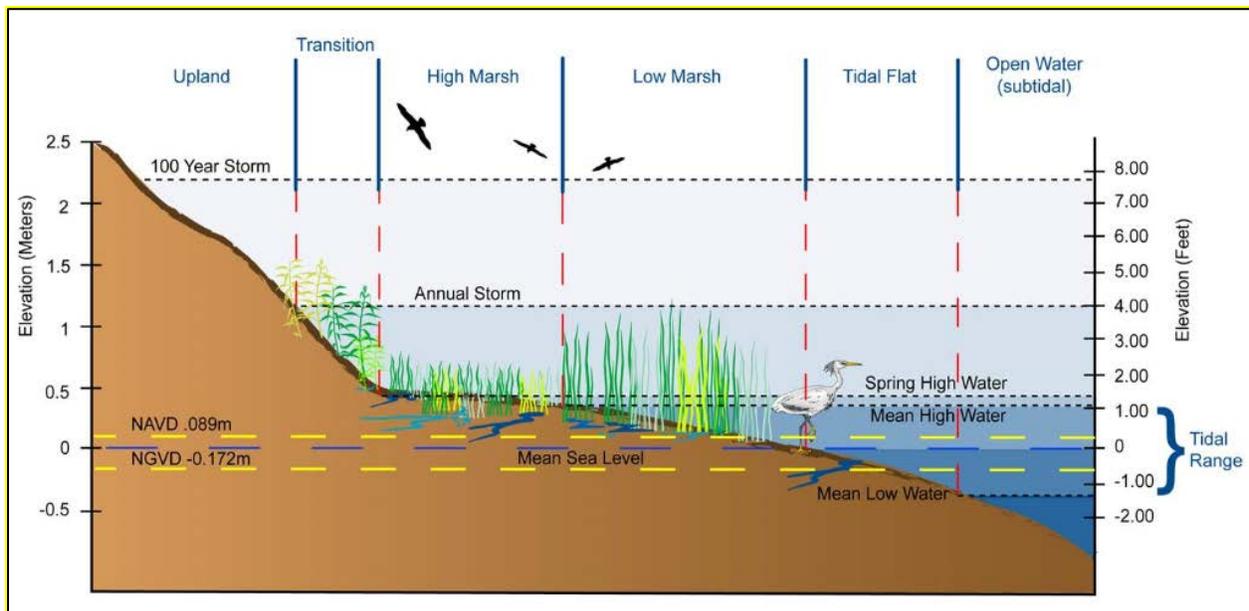
Active Ingredient	Mammals	Birds	Invertebrates
2,4 –D	Not Allowed	Not Allowed	Not Allowed
Aminopyralid	0.22	0.11	Not Allowed
Chlorsulfuron	0.083	0.083	Not Allowed
Clethodim	Not Allowed	Not Allowed	Not Allowed
Clopyralid	0.375	0.375	0.375
Dicamba	Not Allowed	Not Allowed	Not Allowed
Glyphosate	2.0	2.0	2.0
Imazapic	0.189	0.189	Not Allowed
Imazapyr	1.0	1.0	Not Allowed
Metsulfuron	0.125	0.125	Not Allowed
Picloram	Not Allowed	Not Allowed	Not Allowed
Sethoxydim	0.3	0.3	0.3
Sulfometuron	Not Allowed	Not Allowed	Not Allowed
Triclopyr (TEA)	Not Allowed	Not Allowed	Not Allowed

4.3.3 Category 3c: Manage Vegetation Using Herbicides (Estuarine Systems)

Description

Invasive plant treatments in tidally influenced areas are proposed within tidal wetlands and areas below the Ordinary High Water (OHW)³¹. Treatment areas below the OHW have been subdivided into High Marsh, Low Marsh, and Tidal Flat as each area has differing inundation levels and therefore delivery routes to surface waters (Figure 4). High Marsh tidal areas are subject to seasonal inundation, mainly in winter and are often dry during the summer months. Low Marsh areas are below mean high water and are subject to daily to semi-daily tidal influence. While application to open water is not proposed within the Tidal Flats, emergent vegetation such as knotweed and aquatic bed species such as yellow flag iris may be present in permanently inundated areas. These areas shall be treated by hand wiping or wicking or mechanical methods only.

Figure 4 Estuarine Herbicide Treatment Areas



The various treatment methodologies, proposed herbicides, timing, and acreage limit are illustrated above. In High Marsh Areas, there are a larger amount of proposed herbicides and a larger acreage limit. However herbicide application shall be limited to be between July-October. If application must occur between November-July only glyphosate and imazapyr shall be used with a minimum dry time of 4 hours for imazapyr and glyphosate prior to tidal inundation.

In the Low Marsh only glyphosate and imazapyr shall be used with a minimum dry time of 4 hours prior to tidal inundation. Episodic flow events shall be monitored and avoided. In Tidal

³¹ For the purposes of this guidance the OHW is consistent with the transition from obligate wetland vegetation (sedges and rushes) to terrestrial vegetation where the presence and action of waters are so common and usual as to mark upon the soil a character distinct from that of the abutting upland.

Flats/aquatic beds no application of herbicides over standing waters is proposed (Table 7). However treatment of emergent vegetation using hand application or mechanical treatments shall occur.

Table 7 Herbicide Treatment and Methodology by Treatment Area

	High Marsh	Low Marsh	Tidal Flat / Aquatic Bed
Methodology	Broadcast Application ³² or Backpack Sprayer/Bottle ³³	Broadcast Application or Backpack Sprayer/Bottle	Hand Application ³⁴ Wicking/Wiping/Injection
Herbicides	Glyphosate (Aquatic) Imazapyr (Aquatic) Imazapic (Aquatic) Triclopyr TEA	Glyphosate (Aquatic) Imazapyr (Aquatic)	Glyphosate (Aquatic) Imazapyr (Aquatic)
Limit (per project per year)	200 acres	40 acres	<2 acres
Timing	Summer months	Low tidal cycle	Extreme low tide within the in-water work window

Conservation measures

- 1) Only Hasten and Agri-dex surfactants shall be allowed.
- 2) Only aquatic formulations of herbicides are allowed.
- 3) Tidal elevations are project-specific and shall be confirmed at the project level.
- 4) Time herbicide application to coincide with the lowest low tide sequence of the month (occurring during daylight hours) in order to allow for maximum drying time prior to inundation.
- 5) For ATV mounted herbicide application, use boom heights < 4 feet where possible and < 6 feet if needed to treat tall vegetation. Observe buffer widths of 15' from standing water and that the required dry time will occur before inundation by tides. Use drift-reducing nozzles that do not exceed 45 psi sprayer pressure with 200-800 µm droplet size. Treatment may be combined with mechanical control.

³² Ground-based only broadcast application methods via truck/ATV with motorized low-pressure, high-volume sprayers using spray guns, broadcast nozzles, or booms.

³³ Spot and localized foliar and basal/stump applications using a hand-pump backpack sprayer or field-mixed or pre-mixed hand-operated spray bottle.

³⁴ Hand applications to a specific portion of the target plant using wicking, wiping or injection techniques. This technique implies that herbicides do not touch the soil during the application process.

- 6) Apply herbicide to allow for a minimum 4-hour dry time for glyphosate and Imazapyr.
- 7) During hand application (such as wicking, wiping, and stem injection), herbicides must not come into contact with soil or water.
- 8) If appropriate for the plant species prioritize mechanical removal of aquatic bed vegetation over herbicide application in inundated areas.
- 9) Follow-up monitoring and invasive plant treatments shall occur for a minimum of three years after initiating invasive species control or large scale restoration.
- 10) Use marker dye in mixes to track where herbicide has been sprayed and reduce herbicide use.
- 11) Increase spray droplet size (>200um) by decreasing spray pressure, using high flow rate nozzles, using water diluents instead of oil, and/or thickening agents.
- 12) Wind and other weather data will be monitored and reported for all broadcast applications.
- 13) Do not apply herbicides if a precipitation event is forecasted by the NOAA National Weather Service or other similar forecasting service within 48 hours following application.
- 14) Do not spray when wind speeds exceed 10 miles per hour, or are less than 2 miles per hour.
- 15) In Low Marshes use equipment like amphibious tractors as the platform to treat large, infested areas and minimize disturbance by minimizing ingress/egress points. The equipment has less ground pressure than a person.
- 16) When using mechanical control methods ensure that site drainage is maintained and depressions are not created that could potentially trap fish.
- 17) **ESA-Listed Terrestrial Species.** On sites where ESA-listed **terrestrial wildlife** may occur (within 1 mile of habitat where ESA-listed terrestrial wildlife occur), herbicide use will be limited to the chemicals and application rates as shown in Table 8 below. Staff will avoid any potential for direct spraying of wildlife, or immediate habitat in use by wildlife for breeding, feeding, or sheltering.

Table 8 Maximum Application Rates within 1 Mile of Habitat where ESA-listed Terrestrial Species Occur in the Estuary (lb./ac)

	Mammals	Birds	Invertebrates
Glyphosate	2.0	2.0	2.0
Imazapic	0.189	0.189	Not Allowed
Imazapyr	1.0	1.0	1.0
Triclopyr (TEA)	Not Allowed	Not Allowed	Not Allowed

4.3.4 Category 3d: Juniper Removal

Description

This restoration action will be conducted in riparian areas and adjoining uplands to help restore plant species composition and structure that would occur under natural fire regimes. Juniper removal will occur in those areas where juniper have encroached into riparian areas as a result of fire exclusion, thereby replacing more desired riparian plant species such as willow, cottonwood (*Populus* spp.), aspen (*Populus tremuloides*), alder (*Alnus* spp.), sedge, and rush. Guidelines on management of western juniper can be found at:

<http://www.oregon.gov/OWEB/MONITOR/docs/westernjunipermanagementfieldguide.pdf>.

Conservation measures

- 1) Remove juniper to natural stocking levels where 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.
- 3) Felled trees may be left in place, lower limbs may be cut and scattered, or material may be piled and burned.
- 4) Where appropriate, juniper may be cut or removed with rootwads intact and placed into stream channels and floodplains to provide aquatic benefits. Removal with rootwads should utilize appropriate soil stabilization techniques and not cause increased sedimentation or erosion into adjacent waters.
- 5) On steep or south-facing slopes, where ground vegetation is sparse, leave felled juniper in sufficient quantities to promote reestablishment of vegetation and prevent erosion.
- 6) If seeding is a part of the action, consider whether seeding will be most appropriate before or after juniper treatment.
- 7) When using heavy 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 area along stream channels) shall be maintained.

4.3.5 Category 3e: Prescribed burning

Description

Prescribed burning is the measured application of fire to control invasive woody plants. The technique involves the hand application of fire via drip torches or similar equipment.

Conservation measures

- 1) A 15 m (50 feet) vegetative buffer will be maintained adjacent to any fish-bearing stream.
- 2) A burn plan is required, although it may vary by management objectives and site conditions.
- 3) Firebreaks will be used to prevent fire from spreading outside of the planned burn area. Fire retardant chemicals will be used sparingly and will not be used within 37 m (120 feet) of surface waters.
- 4) An area 3 to 6 m (10 to 20 feet) wide may also be mowed around the outside boundary of the burn area to help ensure fire control.
- 5) Fire management vehicles will be restricted to travel across non-native or resilient vegetation except during an emergency, and then for only the duration of the emergency.
- 6) Slash pile burning shall occur when wildfire risk is low (usually winter or spring when soils are frozen or saturated).
- 7) **Timing or Season**³⁵: Treatment may be conducted at any time of year when conditions are suitable with the following caveats:
 - 8) March 1 – June 30: delay implementation until 2 hours after sunrise to avoid disturbing sage-grouse breeding activities,
 - 9) May 15 – July 15: avoid conducting treatments during the primary bird nesting season; if impractical to avoid, minimize impacts by beginning treatments prior to start of nesting season and continue daily activity to discourage bird nesting in treatment area and avoid cutting trees with observed nests until after nesting season.



³⁵ Migratory Bird Treaty Act Requirement.

4.4 Category 4: Piling Removal

Description

BPA proposes to remove creosote-treated wooden pilings from waterways in the Columbia River Basin.

Conservation measures

- 1) The following steps will be used to minimize creosote release, sediment disturbance, and total suspended solids:
 - a) Install a floating surface boom to capture floating surface debris.
 - b) Keep all equipment (e.g., bucket, steel cable, vibratory hammer) out of the water; grip the piles above the waterline.
 - c) Complete all work during low water and low current conditions.
 - d) Dislodge pilings with a vibratory hammer whenever feasible; never intentionally break a pile by twisting or bending.
 - e) Slowly lift the pile from the sediment and slowly lift it through the water column.
 - f) Place the pile 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 straw bales or another support structure to contain all sediment. Return flow may be directed back to the waterway.
 - g) Fill the holes left by each piling with clean, native sediments.
 - h) Dispose of all removed piles, floating surface debris, sediment spilled on work surfaces, and all containment supplies at a permitted upland disposal site.
- 2) 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.
 - a) If the pile cannot be removed without excavation, the stump will be sawn off at the surface of the sediment.
 - b) If a pile breaks above contaminated sediment, the stump will be sawn off at the sediment line.
 - c) If a pile breaks within contaminated sediment, no further effort will be made to remove it. The hole will be covered with a cap of clean substrate appropriate for the site.
 - d) If dredging is likely in the area of piling removal, global positioning system (GPS) device will be used to note the location of all broken piles for future use in site debris characterization.

4.5 Category 5: Road and Trail Maintenance and Decommissioning

4.5.1 Category 5a: Road Maintenance

Description

BPA proposes to fund road maintenance activities, including:

- 1) Creating barriers to human access, e.g., gates, fences, boulders, logs, tank traps, vegetative buffers, and signs
- 2) Surface maintenance, e.g., building and compacting the road prism, grading, and spreading rock or surfacing material
- 3) Drainage maintenance and repair of inboard ditch lines, water bars, and sediment traps
- 4) Removing and hauling or stabilizing pre-existing cut and fill material or slide material
- 5) Relocating portions of roads and trails to less sensitive areas outside of riparian buffer areas

The proposed activity does not include asphalt resurfacing, widening roads, or new construction/relocation of any permanent road inside a riparian area except for a bridge approach, in accordance with the section on **Transportation Infrastructure** (Section 2.1).

Road grading and shaping will maintain, not destroy, the designed drainage of the road, unless modification is necessary to improve drainage problems that were not anticipated during the design phase. Road maintenance will not be attempted when surface material is saturated with water and erosion problems could result.

Conservation Measures

- 1) Dust-abatement additives and stabilization chemicals (typically magnesium chloride or calcium chloride salts) will not be applied within 25 feet of water or a stream channel and will be applied so as to minimize the likelihood that they will enter streams.
- 2) Spill containment equipment will be available during chemical dust abatement application.
- 3) No petroleum-based products will be used for dust abatement.
- 4) Dust abatement applications will be avoided during or just before wet weather and at stream crossings or other locations that could result in direct delivery to a water body (typically within 25 feet of a water body or stream channel).
- 5) Waste material generated from road maintenance activities and slides will be disposed of on stable non-floodplain sites approved by a geotechnical engineer or other qualified personnel.
- 6) Disturbance of existing vegetation in ditches and at stream crossings will be minimized to the greatest extent possible.

- 7) Ditches and culverts will be promptly cleaned of materials resulting from slides or other debris.
- 8) Berms will not be left along the outside edge of roads, unless an outside berm was specifically designed to be a part of the road, and low-energy drainage is provided.
- 9) Ditch back-slopes will not be undercut to avoid slope destabilization and erosion acceleration.
- 10) When blading and shaping roads, excess material will not be sidecast onto the fill. All excess material that cannot be bladed into the surface will be hauled to an appropriate site. Haul and prohibition of sidecasting will not be required for organic material like trees, needles, branches, and clean sod; however, fine organics like sod and grass will not be cast into water.
- 11) Slides and rock failures, including fine material of more than approximately ½ yard at one site, will be hauled to disposal sites. Fine materials (1-inch or smaller) from slides, ditch maintenance, or blading may be worked into the road. Scattered clean rocks (1-inch or larger) may be raked or bladed off the road except within either 300 feet of perennial or 100 feet of intermittent streams.
- 12) Road grading material will not be sidecast along roads within ¼ mile of perennial streams and from roads onto fill slopes having a slope greater than 45%.
- 13) Road maintenance will not be conducted when surface material is saturated with water and erosion problems could result.
- 14) Large wood, >9 m in length and >50 cm in diameter, present on roads will be moved intact down-slope of the road, subject to site-specific considerations. Movement down-slope will be subject to the guidance of a natural resource specialist with experience in fish biology.
- 15) Snowplowing will be performed in accordance with the following criteria:
- 16) No chemical additives such as salt or de-icing chemicals will be used in conjunction with snowplowing.
- 17) Drainage holes will be placed in snow berms to provide drainage.
- 18) A minimum of 2 inches of snow will be left on gravel roads during plowing. Paved roads may be scraped to the surface.
- 19) No gravel or surfacing material will be bladed off the road.
- 20) No deliberate sidecasting of snow into or over drainage structures will be permitted.
- 21) Plowing will not be allowed on gravel roads during thaw periods when the road is wet.

4.5.2 Category 5b: Road Decommissioning

Description

BPA proposes to decommission and obliterate (decompact, recontour, or reshape) roads that are no longer needed (e.g., old or temporary logging roads). Water bars will be installed, road surfaces will be in-sloped or out-sloped, asphalt and gravel will be removed from road surfaces, culverts and bridges will be altered or removed, streambanks will be recontoured at stream crossings, cross drains will be installed, fill or sidecast materials will be removed, the road prism will be reshaped, and sediment catch basins will be created.

Conservation Measures

- 1) All bare-soil surfaces will be revegetated to reduce surface erosion.
- 2) Recontour the affected area to mimic natural floodplain contours and gradient to the extent possible.
- 3) Surface drainage patterns will be recreated, and dissipaters, chutes, or rock will be placed at remaining culvert outlets.
- 4) Conduct activities during dry field conditions, generally May 15 – October 15, when the soil is more resistant to compaction and when soil moisture is low.
- 5) Slide and waste material will be disposed of in stable non-floodplain sites unless materials are intended to restore natural or near-natural contours and approved by a geotechnical engineer or other qualified personnel.

4.6 Category 6: In-Channel Nutrient Enhancement

Description

BPA proposes to fund the application of nutrients throughout a waterway corridor by placement of salmon carcasses into waterways, placement of carcass analogs (processed fish cakes) into waterways, or placement of inorganic fertilizers into waterways.

Conservation Measures

- 1) In Oregon, projects are permitted through the Oregon Department of Environmental Quality. Carcasses from the treated watershed or those that are certified disease-free by an ODFW pathologist will be used.
- 2) In Washington, the WDFW publication, entitled “Salmon Carcass Analogs, and Delayed Release Fertilizers to Enhance Stream Productivity in Washington State” (WDFW 2004), will be followed.

- 3) Carcasses will be of species native to the watershed and placed during the normal migration and spawning times, as would naturally occur in the watershed.
- 4) Eutrophic or naturally oligotrophic systems will not be supplemented with nutrients.
- 5) Each waterway will be individually assessed for available light, water quality, stream gradient, and life history of the fish present. Adaptive management will be used to derive the maximum benefits of nutrient enhancement.

4.7 Category 7: Irrigation and Water Delivery/Management Actions

The intent of these activity categories is to increase instream flow and improve habitat for ESA-listed species.

The HIP 4 will only cover irrigation efficiency actions within this activity category that use state-approved regulatory mechanisms (e.g., Oregon ORS 537.455-.500 and Washington RCW 90.42) for ensuring that water savings will be protected as instream water rights, or in cases for which project sponsors identify how the water conserved will remain instream to benefit fish without any significant loss of the instream flows to downstream diversions.

4.7.1 Category 7a: Convert Delivery System to Drip or Sprinkler Irrigation

Description

Flood or other inefficient irrigation systems will be converted to drip or sprinkler irrigation. Education will be provided to irrigators on ways to make their systems more efficient. This proposed activity will involve the installation of pipe, possibly trenched and buried into the ground, and possibly pumps to pressurize the system.

Guidelines for Review

- Low - Medium Risk: Shall require an initial HIP review. The HIP review will confirm that that designs are adequate, objectives are clearly stated, agreements for water diversion and bypass flows are enforceable, and a monitoring protocol will be employed to ensure that expected flow improvements are realized.

Conservation Measures

The designs must identify the approximate downstream extent of the flow benefit and must demonstrate that consumptive use of water will not appreciably increase, how surface water withdraws will be reduced, and how instream flow will be increased.

4.7.2 Category 7b: Convert Water Conveyance from Open Ditch to Pipeline

Description

Open ditch irrigation water conveyance systems will be replaced with pipelines to reduce evaporation and transpiration losses. Leaking irrigation ditches and canals will be converted to pipeline or lined with concrete, bentonite or other appropriate lining materials.

Guidelines for Review

Low - Medium Risk: Shall require an initial HIP review. The HIP review will confirm that that designs are adequate, objectives are clearly stated, agreements for water diversion and bypass flows are enforceable, and a monitoring protocol will be employed to ensure that expected flow improvements are realized.

Conservation Measures

The designs must demonstrate how there is a net instream benefit by reducing surface water withdrawals during all periods when the diversion is active.

4.7.3 Category 7c: Convert from Instream Diversions to Groundwater Wells

Description

Wells will be drilled as an alternative water source to surface water withdrawals. Water from the wells will be pumped into ponds or troughs for livestock or used to irrigate agricultural fields. Instream diversion infrastructure will be removed or downsized, if feasible. If an instream diversion is downsized, it will only be covered under the HIP 4 by following all criteria outlined in the Consolidate or Replace Existing Irrigation Diversions section.

Guidelines for Review

- **Low Risk:** Shall not require HIP Review.

Conservation Measures

New wells will be located more than ¼ mile from the stream and will not be hydrologically connected to the stream.

4.7.4 Category 7d: Install or Replace Return Flow Cooling Systems

Description

Above-ground pipes and open ditches that return tailwater from flood-irrigated fields back to the river will be replaced. Return flow cooling systems will be constructed by trenching and burying a network of perforated PVC pipes that will collect irrigation tailwater below ground, eliminating pools of standing water in the fields and exposure of the water to direct solar heating. No instream work is involved, except for installing the drain pipe outfall. Most work will be in uplands or in riparian buffer areas that are already plowed or grazed.

Guidelines for Review

- ***Low Risk:*** Shall not require HIP Review.

4.7.5 Category 7e: Install Irrigation Water Siphons

Description

Siphons transporting irrigation water will be installed beneath waterways, where irrigation ditch water currently enters a stream and commingles with stream water, with subsequent withdrawal of irrigation water back into an irrigation ditch system downstream. Periodic maintenance of the siphon will be conducted. Work may entail use of heavy equipment, power tools, and/or hand tools.

Guidelines for Review

- ***Low Risk:*** Siphons that meet all conservation measures.
- ***Medium Risk: Siphons*** that do not meet all conservation measures and require significant in-channel work shall require a review by BPA Engineering.

Conservation Measures

- 1) Directional drilling to create siphon pathway will be employed whenever possible.
- 2) Trenching will occur in dry stream beds only.
- 3) Work area isolation will be employed in perennial streams.
- 4) Stream widths will be maintained at bankfull width or greater
- 5) No part of the siphon structure will block fish passage.
- 6) No concrete will be placed below the bankfull elevation.
- 7) Siphon surface structures will be set back from the bankfull elevation at least 10 feet.
- 8) Minimum cover over a siphon structure within the streambed shall be 3 feet of natural substrate.

- 9) Waterways will be reconstructed to a natural streambed configuration upon completion.
- 10) The criteria, plans and specifications, and operation and maintenance protocols of this activity category shall use the most recent versions of Natural Resource Conservation Service (NRCS) guidance.

4.7.6 Category 7f: Livestock watering facilities

Description

Watering facilities will consist of various low-volume pumping or gravity-feed systems to move the water to a trough or pond at an upland site. Either above-ground or underground piping will be installed between the troughs or ponds and the water source. Water sources may include springs and seeps, streams, or groundwater wells. Pipes will generally range from 0.5 to 4 inches but may exceed 4 inches in diameter. Placement of the pipes in the ground will typically involve minor trenching using a backhoe or similar equipment.

Conservation measures

- 1) The location shall avoid steep slopes.
- 2) Each livestock water development shall have a float valve or similar device limiting use to demand and include a return flow system.
- 3) The livestock water development shall include a fenced overflow area or similar means to minimize water withdrawal and minimize potential runoff and erosion.
- 4) All pumping and gravity-feed systems within habitat occupied by ESA-listed salmonids will have fish screens to avoid juvenile fish entrainment and will be operated in accordance with NMFS' current fish screen criteria (NMFS 2011 or most recent version).
- 5) If pumping rate exceeds 3 cfs, a NMFS Engineering Review will be necessary.
- 6) In areas where larval lamprey could be entrained, screening should use perforated plate, vertical bar or interlocking bar screens and avoid the use of wire cloth.



4.7.7 Category 7g: Install, upgrade, or maintain fish exclusion devices and bypass systems

Description

This category includes installing, replacing, upgrading, removing, or maintaining fish exclusion screens and associated fish bypass systems to prevent fish entrapment in irrigation canals or other surface-water diversions for existing legal water diversions. This category does not cover screen installations for new water diversions.

Operations and Maintenance

Fish screen operation and maintenance actions are typically minor in nature and may include:

- 1) Lubricate moving parts
- 2) Manually clean screen material, bypass pipes, and trash racks
- 3) Maintain bypass outfalls to ensure a safe landing area for fish and maintain entrance areas to minimize false attraction flows.
- 4) Remove material from bypass pipe to maintain safe fish return to waterway
- 5) Inspect and replace screen seal material
- 6) Adjust weir boards and/or bypass orifice to maintain proper water levels for screen's submergence and debris removal
- 7) Replace screen material, bypass pipe, gear boxes, u-joints, bearings, and other worn-out parts
- 8) Adjust cleaning arms, carriages, cable, pulleys, and brushes to maintain good contact with screen for debris removal
- 9) Remove accumulated sediment and debris by hand
- 10) Mechanical removal of vegetation that prevents fish screens from operating properly
- 11) Replace batteries and other components of solar power systems
- 12) Repair paddlewheels and other components of paddlewheel driven power systems
- 13) Remove sediment and debris and/or adjust fish passage conditions in fishways by hand
- 14) Annual installation or removal of fish screen and components
- 15) Screen adjustments
- 16) Install water measuring devices behind fish screens (dewatered)
- 17) Inspect, maintain, or repair headgates at the start of diversions (dewatered)
- 18) Inspect, maintain, or repair return flow outlets

Guidelines for Review

Operation and maintenance actions require little to no in-water work. These activities may occur outside the in-water work window without a variance and do not require turbidity monitoring, or NMFS Engineering Review.

The sponsor may submit one PNF form to BPA for all anticipated low-risk fish screen actions for each field season. The PNF shall include a list of proposed activities and locations

(latitude/longitude in decimal degrees), where these operation and maintenance activities will take place. At the end of the field season, the PCF shall contain actual locations where work took place and any activities that occurred beyond what was originally proposed (i.e., the operation and maintenance actions list above).

New Construction

This involves new structures or expansion of existing structures with construction that requires ground disturbance or in-water work. Installation of a fish screen typically involves excavation, installation of bedding material, construction of forms for pouring concrete, installation of the screen and cleaning system, and backfilling of bedding and other material.

Examples include but are not limited to:

- 1) Install/replace/modify/remove fish bypass
- 2) Install/replace/modify/remove fish screens and associated pipes on gravity or pump intakes
- 3) Install/replace/modify/remove fishway
- 4) Remove accumulated sediment and debris with heavy machinery
- 5) Assess and repair concrete or steel support structures
- 6) Repair or replace screen due to damage from extreme weather event
- 7) Install/replace/modify/remove headgates at the start of diversions
- 8) Install, replace, or modify structures with the intent to improve fish passage and/or flow, typically by removing or modifying a full or partial instream barrier
- 9) Install/replace/modify/remove fish exclusion barriers on ditch return flow outlets

Guidelines for Review

If these activities can occur entirely isolated from the stream (e.g. behind a closed headgate), with no fish present, then they may occur outside the in-water work window without a variance.

Project sponsors may submit one PNF to BPA for all fish screen construction projects. This PNF shall contain anticipated project locations (latitude/longitude at a minimum), specific activities, and at a minimum general descriptions for each activity that may occur at multiple locations. At the end of the field season, the PCF shall contain locations where fish screen projects occurred, specific activities undertaken, incidental take reporting, turbidity monitoring, and any details on in-water work done outside recommended in-water work windows.

Fish screen construction projects require reporting of incidental take (capture/injury/kill) of ESA-listed salmonids and monitoring turbidity according to HIP 4 guidance.

If there is in-water work, these activities shall occur during the recommended in-water work window. If this is not possible, either a variance or a rationale provided by a state biologist in regard to the deviation shall be required.

Conservation Measures

- 1) Diversion water intake and return points will be installed, replaced, upgraded, removed, or maintained to prevent salmonids of all life stages from swimming into, or being entrained within, the diversion system.
- 2) All fish screens (including screens installed on temporary and permanent pump intakes) and fish bypass systems will be designed, constructed, installed, operated, and maintained according to NMFS fish screen criteria, detailed in *Anadromous Salmonid Passage Facility Design* (NMFS 2011 or most recent version).
- 3) NMFS Engineering Review and approval is required for all fish screens with diverted flow by gravity or pumping at a rate that exceeds 3 cubic feet per second.
- 4) In areas where larval lamprey could be entrained, recommended screening is perforated plate, vertical bar or interlocking bar screens and avoid the use of wire cloth.



4.8 Category 8: Fisheries, Hydrologic, and Geomorphologic Surveys

Description

BPA proposes to fund the collection of information in uplands, wetlands, floodplains, and streambeds regarding existing on-the-ground conditions relative to:

- habitat type, condition, and impairment;
- species presence, abundance, and habitat use; and
- conservation, protection, and rehabilitation opportunities or effects.

Electro-shocking and fish handling for research purposes is not included, as this work must have an ESA Section 10 research permit.

Work may entail use of trucks, survey equipment, and crews using hand tools, and includes the following activities:

- 1) Measuring/assessing and recording physical measurements by visual estimates or with survey instruments
- 2) Installing rebar or other markers along transects or at reference points
- 3) Installing piezometers and staff gauges to assess hydrologic conditions
- 4) Installing recording devices for stream flow and temperature
- 5) Conducting snorkel surveys to determine species of fish in streams and observing interactions of fish with their habitats
- 6) Excavating cultural resource test pits
- 7) Installing PIT detector arrays

4.9 Category 9: Special Actions

4.9.1 Category 9a: Install/Develop Wildlife Structures

Description

This activity involves the installation or development of a variety of structures that mimic natural features and provide support for wildlife foraging, breeding, and/or resting/refuge. These can include bat roosting/breeding structures, avian nest boxes, hardwood snags, brush/cover piles, coarse woody debris, and raptor perches. Work may entail use of power tools and/or crews with hand tools.

Wildlife nesting structures should be:

- 1) Built for specific native avian and mammalian species.
- 2) Designed for easy cleaning and maintenance.
- 3) Properly suspended or supported.
- 4) Protected from wind driven rain.
- 5) Properly ventilated.
- 6) Designed to eliminate predation or placed in protected areas.
- 7) Built without perches to prevent house sparrow and starling occupancy.
- 8) Constructed with pine, plywood, cedar, redwood, or cypress (cedar preferred).
- 9) Do not use pressure treated or creosote-based wood products for any part of a nesting or feeding structure unless it is in direct contact with the ground, such as a mounting post.



4.9.2 Category 9b: Construct Fencing for Grazing Control

Description

Permanent or temporary livestock exclusion fences or cross-fences will be installed to assist in grazing management. If applicable, shall include cattle guards or water gaps for livestock. Individual fence posts will be pounded or dug using hand tools or augers on backhoes or similar equipment. Fence posts will be set in the holes and backfilled. Fence wire will be strung or wooden rails placed. Installation may involve the removal of native or non-native vegetation along the proposed fence line. Occasionally rustic wood X-shaped fence that does not require setting posts will be used.

Conservation Measures

- 1) No grazing will be allowed within riparian area fenced enclosures unless there is a BPA approved grazing management plan that uses flash grazing to control invasive species or otherwise promote growth of native riparian vegetation.
- 2) A minimum of 35 feet buffer is required from fence to bankful width.

4.9.3 Category 9c: Plant Vegetation

Description

Trees, shrubs, vines, grasses, and legumes will be planted to stabilize soils in areas with severe erosion or high erosion potential. Trees such as cottonwoods and conifers will be planted. Plants

and seeds will be obtained from local sources to ensure plants are adapted to local climate and soil chemistry.

Planting sites will be prepared by cutting, digging, grubbing roots, scalping sod, de-compacting soil as needed, and removing existing vegetation. The ground will be scarified as necessary to promote seed germination. Woody debris, wood chips, or soil may be placed at select locations to alter microsites.

Plants will be fertilized, mulched, and stems wrapped to protect from rodent girdling. Buds will be capped to protect plants from herbivores. Work may entail use of heavy equipment, power tools, and/or hand tools.

Because noxious weeds, nonnative invasive plants, and aggressive weedy species can take over disturbed lands and degrade range values, vegetation will be controlled through the use of herbicide application, mechanical removal, and hand pulling.

Conservation Measures

- 1) Plantings will be in areas where such plants have historically occurred but at present are either scarce or absent.
- 2) A vegetation plan will be developed that is responsive to the biological and physical factors at the site.
- 3) Planting plans shall require the use of native species and specify seed/plant source, seed/plant mixes, soil preparation, etc.
- 4) Planting Plans shall include vegetation management strategies that are consistent with local native succession and disturbance regime.
- 5) Vegetation Plans shall address the abiotic factors contributing to the sites' succession, i.e., weather and disturbance patterns, nutrient cycling, and hydrologic condition.

4.9.4 Category 9d: Tree Removal for Large Wood Projects

Description

This activity involves manipulation, harvest, placement, or removal and stockpiling of large wood for restoration projects. For this activity live conifers and other trees can be felled or pulled/pushed over for in-channel large wood placement. These trees will come from areas fully stocked by conifers and other trees. Danger trees and trees killed through fire, insects, disease, blow-down, and other means can be felled and used for in-channel placement regardless of live-tree stocking levels. Trees may be removed by cable, ground-based equipment, or helicopter. Trees may be felled or pushed/pulled directly into a stream or floodplain. Trees may be stockpiled for future instream restoration projects.

Conservation Measures

- 1) The project manager for an aquatic restoration action will coordinate with BPA's Environmental Compliance Lead and/or an action-agency wildlife biologist in tree-removal planning efforts.
- 2) Tree felling shall not create excessive streambank erosion or increase the likelihood of channel avulsion during high flows.
- 3) If these actions fall within the range of specific listed terrestrial species such as the northern spotted owl (NSO) and/ or the marbled murrelet (MAMU), timing and or equipment/distance restrictions will be applied as necessary.

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