FY 2023
HIP HANDBOOK

Guidance of Programmatic Requirements and Process

Bonneville
POWER ADMINISTRATION

TABLE OF CONTENTS

"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/smoother/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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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 (HIP4) and future versions:

> Endangered Species Act Section 7(a)(2) Biological Opinion, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Fish and Wildlife Habitat Improvement Program (HIP 4) in Oregon, Washington and Idaho (NMFS# WCRO-2020-00102). Issued 5/7/2020
>
> Fish and Wildlife Service's Biological Opinion on the Habitat Improvement Program (FWS reference: 01EOFW00-19FY-F-0710; BPA reference: EC-4). Issued 5/15/2020.

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. It is intended to promote consistency across the Columbia River Basin, while retaining the expertise of Hydraulic Engineers, Fishery Biologists and the River Restoration Industry to ensure the success of BPA-funded restoration actions. Sponsor comments were accepted when previous versions of the Handbook were made public in the summer of 2014-2021. The HIP Handbook thus incorporates lessons learned from project Sponsors across the basin, as well as current technical and scientific literature addressing process based river restoration.

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 (NWPCC's) Columbia River Basin Fish and Wildlife Program, and the various BiOps issued to BPA including the 2020 BiOp addressing the continued operation and maintenance of the Columbia River System (CRS).

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 (BPA EC Lead) for additional requirements.

1.2 HIP BO Categories of Action

HIP Categories of Action include:

Category 1: Fish Passage Restoration (Profile Discontinuities)
- 1a) Dams, Water Control Structures, 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 Connectivity
- 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 and Wetland Vegetation Planting
- 2f) Channel Reconstruction
- 2g) Install Habitat-Forming Natural Materials (Sediment and Gravel)

Category 3: Invasive Plant Control
- 3a) Manage Vegetation Using Physical Controls
- 3b) Manage Vegetation Using Herbicides (Riverine Systems)
- 3c) Manage Vegetation Using Herbicides (Estuarine Systems)
- 3d) Manage Vegetation Using Herbicides (Willamette Basin Sloughs, Side Channels, and Wetlands)
- 3e) Juniper Removal
- 3f) Prescribed Burning

Category 4: Piling Removal

Category 5: Road and Trail Maintenance and Decommissioning
- 5a) Road Maintenance
- 5b) Road Decommissioning

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
- 7c) Convert from Instream Diversions to Groundwater Wells
- 7d) Install or Replace Return Flow Cooling Systems
- 7e) Install Irrigation Water Siphons
- 7f) Livestock Watering Facilities
- 7g) Install, Upgrade, or Maintain Fish Exclusion Devices and Bypass Systems

Category 8: Fisheries, Hydrologic, and Geomorphologic Surveys

Category 9: Special Actions (for Terrestrial Species)
- 9a) Install/Develop Wildlife Structures
- 9b) Construct Fencing for Grazing Control
- 9c) Plant Vegetation
- 9d) Tree Removal for Large Wood Projects
- 9e) Willamette Valley Prairie Restoration

1.3 Consistency Review

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. The Services will determine if proposed project within the scope of the analysis of the BiOps.

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.	2a – 2g	✓	low-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).	2a, 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-med
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-med
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, 2d, 2f, 9a	✓	low-high
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-med
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, 9c		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-med**
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-2g**	✓	**low-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, 9d**		**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-med**

1.5 ESA-Listed Species Covered Under HIP

ANADROMOUS SALMONIDS (by Evolutionarily Significant Units)	
Lower Columbia River Chinook salmon	***Oncorhynchus tshawytscha***
Upper Willamette River spring-run Chinook salmon	***O. tshawytscha***
Upper Columbia River spring-run Chinook salmon	***O. tshawytscha***
Snake River spring/summer-run Chinook salmon	***O. tshawytscha***
Snake River fall-run Chinook salmon	***O. tshawytscha***
Columbia River chum salmon	***O. keta***
Lower Columbia River coho salmon	***O. kisutch***
Oregon Coast coho salmon	***O. kisutch***
Snake River sockeye salmon	***O. nerka***
Lower Columbia River steelhead	***O. mykiss***
Upper Willamette River steelhead	***O. mykiss***
Middle Columbia River steelhead	***O. mykiss***
Upper Columbia River steelhead	***O. mykiss***
Snake River Basin steelhead	***O. mykiss***
ANADROMOUS FISHERIES	
Pacific eulachon, southern DPS	*Thaleichthys pacificus*
Green sturgeon, southern DPS	*Acipenser medirostris*
FRESHWATER FISH	
Bull Trout	***Salvelinus confluentus***
AMPHIBIANS	
Oregon Spotted Frog	*Rana pretiosa*
MAMMALS	
Canada lynx, contiguous U.S. DPS	*Lynx canadensis*
Columbian white-tailed deer	*Odocoileus virginianus leucurus*
Gray wolf	*Canis lupus*
Grizzly bear	*Ursus arctos horribilis*
North American wolverine	*Gulo gulo luscus*
Northern Idaho ground squirrel	*Urocitellus brunneus*
Pygmy rabbit	*Brachylagus idahoensis*

Woodland caribou – Selkirk Mountain	*Rangifer tarandus caribou*
BIRDS	
Marbled murrelet	***Brachyramphus marmoratus***
Northern spotted owl	*Strix occidentalis caurina*
Streaked horned lark	***Eremophila alpestris strigata***
Yellow Billed Cuckoo	*Coccyzus americanus*
INVERTEBRATES	
Bliss Rapids snail	*Taylorconcha serpenticola*
Snake River Physa snail	*Physa natricina*
Fender's blue butterfly	*Icaricia icarioides fenderi*
Taylor's Checkerspot butterfly	*Euphydryas editha taylori*
PLANTS	
Bradshaw's lomatium	***Lomatium bradshawii***
Golden paintbrush	***Castilleja levisecta***
Howell's spectacular thelypody	*Thelypodium howellii spectabilis*
Kincaid's lupine	***Lupinus sulphureus* ssp. *kincaidii***
McFarlane's four-o'clock	*Mirabilis macfarlanei*
Nelson's checkermallow	***Sidalcea nelsoniana***
Slickspot peppergrass	*Lepidium papilliferum*
Spalding's catchfly	*Silene spaldingii*
Ute ladies'-tresses	*Spiranthes diluvialis*
Water howellia	*Howellia aquatilis*
Wenatchee Mountains checkermallow	*Sidalcea oregana* var. *calva*
Willamette daisy	***Erigeron decumbens***

NOTE: Species in bold have an LAA (Likely to Adversely Affect) Determination and will have incidental take reporting associated with them.


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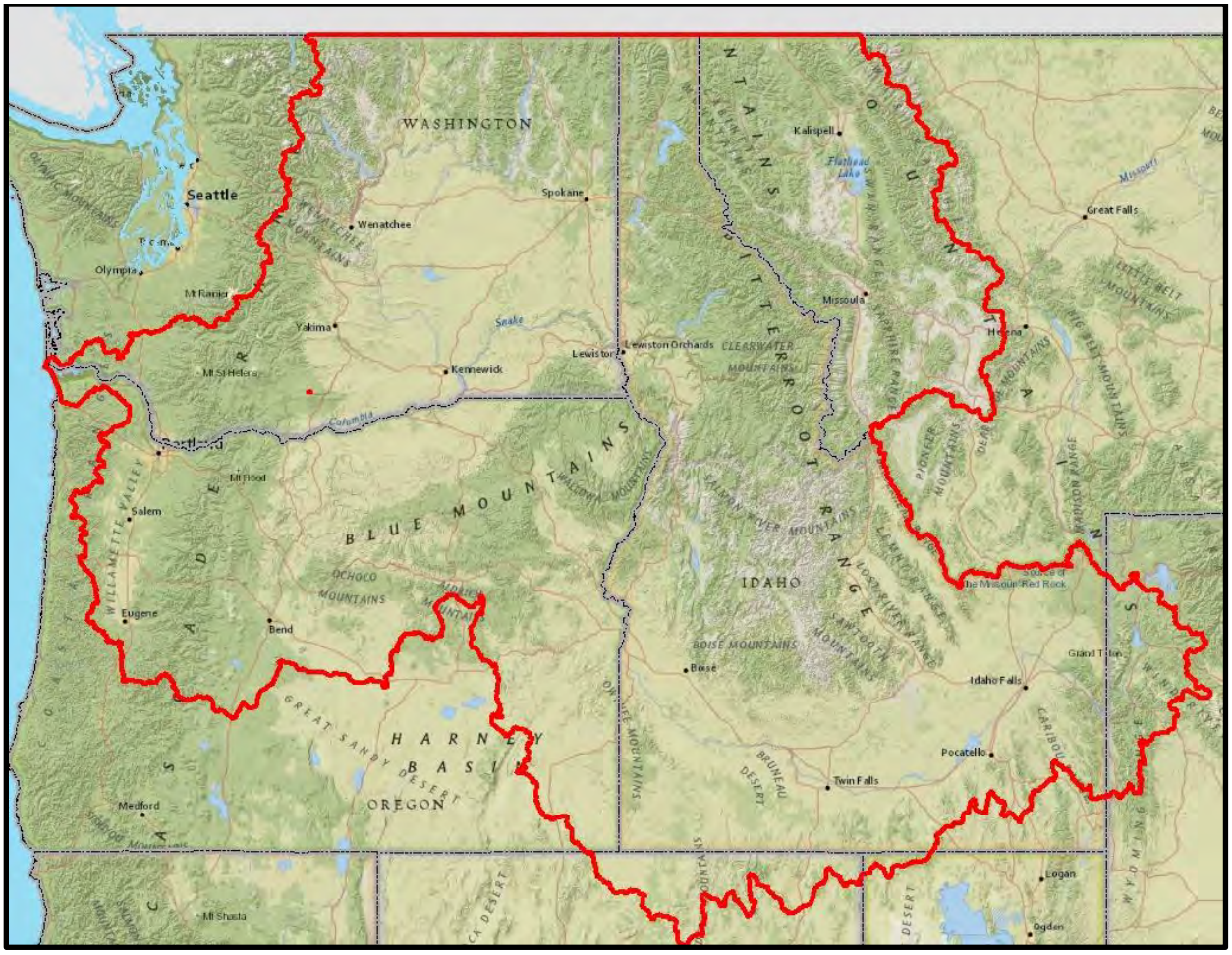
1.6 Action Area

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

HIP REVIEW PARTICIPANTS

Sponsor: Project Sponsor Proposes the Project, Procures Permits
Designer: Subcontractor to the Sponsor
NMFS Branch Chief: Approves High Risk Projects
NMFS Biologist (Interagency Reviewer): Provides BiOp Consistency Review for Anadromous Salmonids
NMFS Engineering: Provides Fish Passage Review
USFWS Field Office Supervisor: Approves High Risk Projects
USFWS Biologist (Interagency Reviewer): Provides BiOp Consistency Review for Non Anadromous Salmonids and Terrestrial Species
BPA COR: Contracting Officer Representative (COR) performing Contract Management
BPA HIP Program Lead: QA/QC HIP Process, Reports to Services
BPA EC Lead: Submits Documentation, Provides Functional Review
BPA Technical Lead: Member of BPA Fish & Wildlife Engineering Technical Services (ETS) that Provides Technical Review

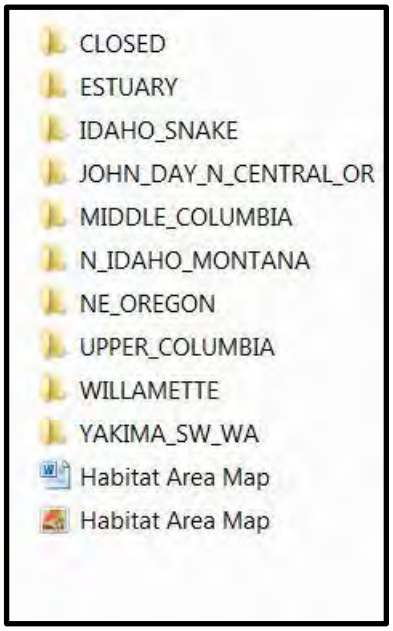
PART 1: RISK DETERMINATION

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

NOTE: Any action that changes the hydraulic character of the river shall be considered medium or high risk. Risk may be lowered following a technical review.

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

1) **BPA 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.



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Current Year — BPA 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 requirements. 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. Please assign a BPA Technical Lead to initiate the technical review.

   g) Schedules internal meeting (if necessary)
   h) Solicits Interagency Participation (for High risk projects)
   i) Schedules site visit (if necessary)

2) **BPA Technical Lead**
   a) Verifies project information
   b) Creates internal ETS Record

c) Assigns lead to perform the technical review
d) Sends notification email to **BPA EC Lead**, and **BPA COR**
e) Verifies Risk Level
f) Attends site visit (if necessary)
g) Determines Review schedule (how many review junctures)

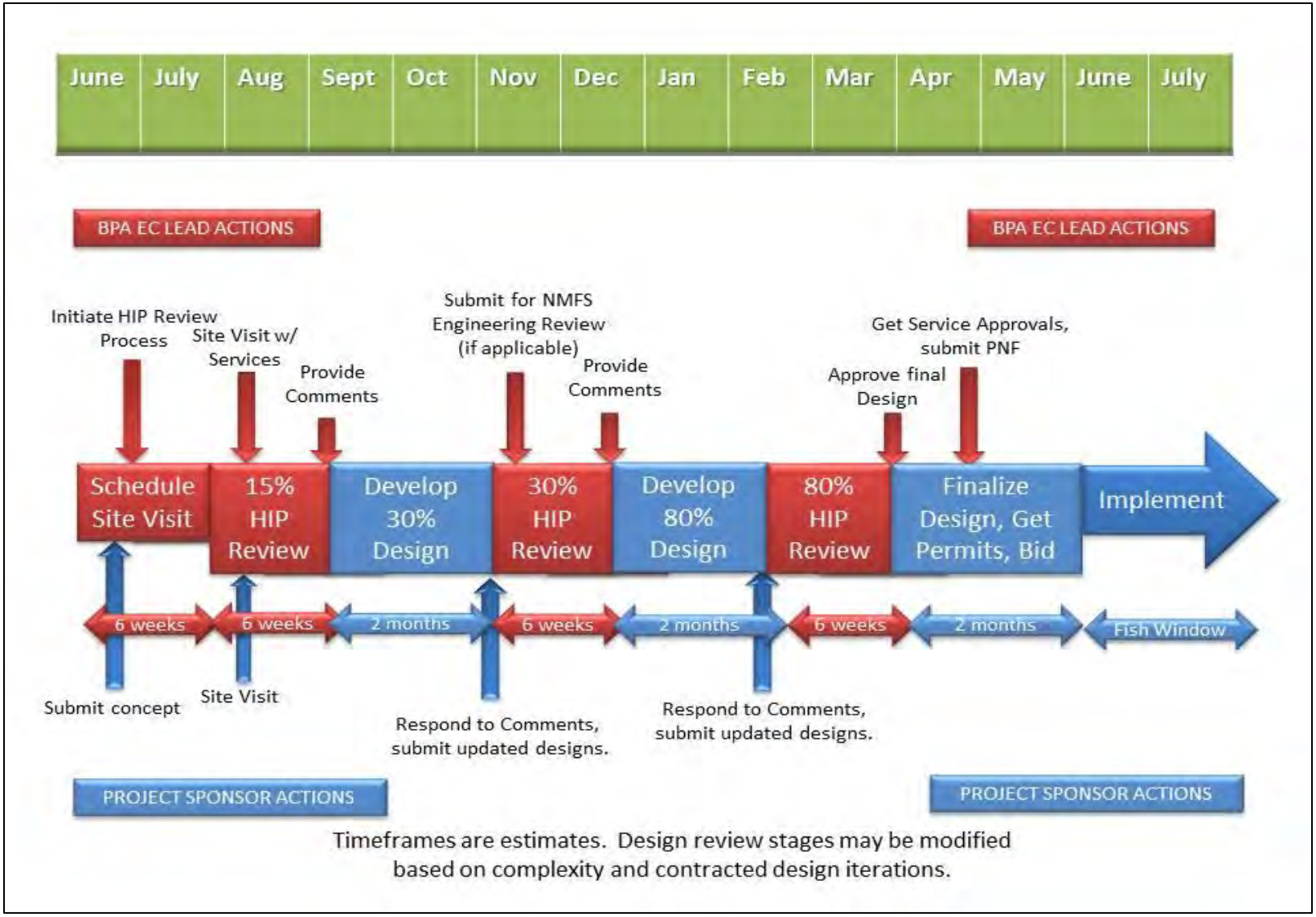
PART 3: TECHNICAL AND FUNCTIONAL REVIEWS

1) **BPA Technical 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 **BPA EC Lead** via HIP Comment Tracking Form.
2) **BPA EC Lead**
   a) Compiles comments from interagency partners (high risk)
   b) Conducts functional review (HIP requirements)
   c) Initiates **NMFS Engineering** review (if required)
   d) Provides comments to **Sponsor** via:
      High/Med Risk Comment Email
   e) Reviews **Sponsor**'s response to comments with **BPA Technical Lead**.
   f) Sets up review meeting with reviewers and **Sponsor** if needed.
   g) Instructs Sponsor to proceed to next review milestone once comments closed.
3) **Sponsor** and **Designer**
   a) Provides response to comments before proceeding with design.
   b) Updates BDR and plans as appropriate once **BPA EC Lead** gives notice to proceed.
4) **BPA HIP Program Lead**
   a) Provides support
   b) Documents process
   c) Arbitrates disagreements

PART 4: CONCLUSION

1) **Sponsor**
   a) Provides final designs and responses to HIP Comment Tracking Form
   b) Drafts PNF
2) **BPA Technical Lead**
   a) Approves final design
3) **BPA EC Lead**
   a) If Med Risk **BPA EC Lead** sends approval email to **Sponsor**
   b) If High Risk **BPA 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) **BPA HIP Program Lead**
   a) Documents conclusion
   b) Verifies project folder contains reviews and emails
   c) QA/QC PNF
   d) Submits PNF to Services

2.2 HIP Review High Risk Timeline

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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. All three of the following review junctures are required for high risk projects unless approved by the EC Lead.

Conceptual Project Review (typically 15%): The Project Sponsor will notify BPA at 15% or project concept stage and help the BPA 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 EC Lead will collate and provide comments from BPA Technical Lead and interagency partners. Once comments are resolved, the BPA 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, a NMFS Engineering review may be required (see Section 2.6). The BPA EC Lead will collate comments from reviewers and interagency partners, and submit them to the Sponsor. The BPA 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 BPA 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 BPA EC Lead and BPA Technical Lead have approved the final design, the BPA EC Lead will proceed with final agency approval and notifications.


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2.4 Risk Determination

Types of Risk: Risk is defined primarily as the potential impacts to ESA-listed species. Risk determination may also consider human life and safety, infrastructure and property, project performance and sustainability, and non ESA-listed species.

Initial Risk Determination: The BPA EC Lead performs the initial risk determination based on the conceptual design submittal (Section 2.3) with advice and recommendations from applicable HIP reviewers assigned to the project (technical reviewer, agency biologists, and agency passage engineers). Each activity category is assigned a risk level, and the overall project carries the risk of the highest rated activity.

Risk Levels: HIP uses low, medium, and high risk level indicators to determine the likely scale of impacts to aquatic species. Activity categories include a description of the risk level assigned to a given project component. Where risk is not identified, risk is assumed to be low. Risk levels are defined as follows:

- Low Risk: Work that typically does not alter the hydraulics or water quality of a stream (i.e. vegetation planting, maintenance activities).
- Medium Risk: Activities that alter the hydraulics or water quality of a stream.
- High Risk: Activities that alter the hydraulics or water quality with increased potential for take. Thresholds for increased risk are described in applicable activity categories. When thresholds are difficult to define or require judgment, the BPA EC Lead may make a high risk determination based on factors for increasing risk below.

Factors for Changing Risk: The BPA EC Lead may make changes to initial risk determinations based on advice and recommendations from HIP reviewers assigned to the project. Risk may be changed throughout the HIP review process. Risk shall be reassessed with significant design changes.

- Increases to Risk:
    - Actions that are considered large in complexity and/or scale.
    - Precedent- and/or policy-setting actions (e.g., application of new technology) or actions that are new to a geographic area, stakeholder group, BPA, or consulting agency;
    - Actions with risks (listed above) in addition to those to ESA-listed species.
- Decreases to Risk:
    - The scale and complexity of a proposed activity is smaller than typical applications.
    - Actions that do not require fish isolation, turbidity management, heavy machinery, stability calculations, and engineering analysis.
    - Thorough and complete project documentation provides justification for lower risk level.

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 Technical Lead and BPA 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.

2.6 Adaptive Management Plans

An adaptive management plan shall be required for channel reconstruction and process-based wood placement 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 for processed based modifications and corrections of unforeseen conditions. An Adaptive Management does not guarantee future BPA funding, but may expedite ESA coverage for adaptive actions.

1) Introduction
2) Responsible parties involved
3) Assessment Protocols
4) Adaptive Management Triggers
5) Assessment Frequency, Timing, and Duration
    a) Baseline Pre-Project 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

2.7 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. NMFS Engineering review may be requested by BPA Technical Lead on any project where fish passage concerns exist. Fish passage review is initiated by the BPA EC Lead typically at the 30% design review juncture.

1a) Dams, Water Control Structures or Legacy Structure Removal.

Small dams with a maximum total head measurement greater than or equal to 3 feet, channel spanning weirs, earthen embankments and spillway systems.

1b) Consolidate, or Replace Existing Irrigation Diversions

Irrigation diversion structures greater than or equal to 3 feet in height that are to be removed or replaced.

1c) Headcut and Grade Stabilization

Installation of boulder weirs, roughened channels and grade control structures that are greater than or equal to 18 inches in height.

1d) Low Flow Consolidation

All projects.

1e) Provide Fish Passage at an Existing Facility

Passage improvements at an existing facility 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.

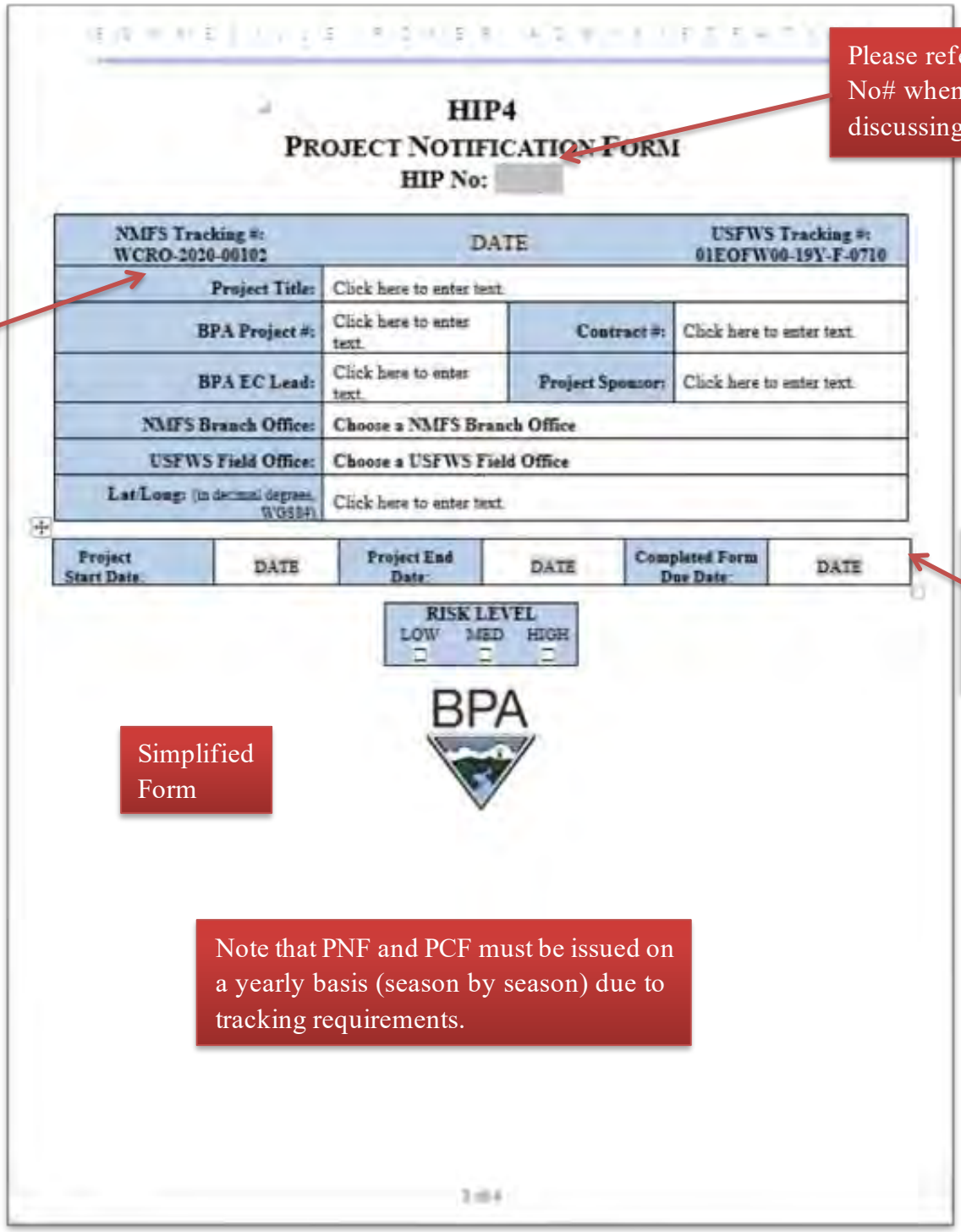
1f) Bridge and Culvert Removal or Replacement

Structures that do not meet 1.5 times bankfull width or when requested by BPA Technical Lead.

7g) Install, Upgrade, or Maintain Fish Exclusion Devices and Bypass Systems

Flow diverted by gravity or pumping at a rate that is greater than or equal to 3 cubic feet per second.

2.8 HIP Forms – Project Notification Form (PNF)



HIP4

PROJECT NOTIFICATION FORM

HIP No:

NMFS Tracking #: WCRO-2020-00102	DATE		USFWS Tracking #: 01EOFW00-19Y-F-0710
Project Title:	Click here to enter text.		
BPA Project #:	Click here to enter text.	Contract #:	Click here to enter text.
BPA EC Lead:	Click here to enter text.	Project Sponsor:	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.		

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

RISK LEVEL

LOW ☐ MED ☐ HIGH ☐

BPA

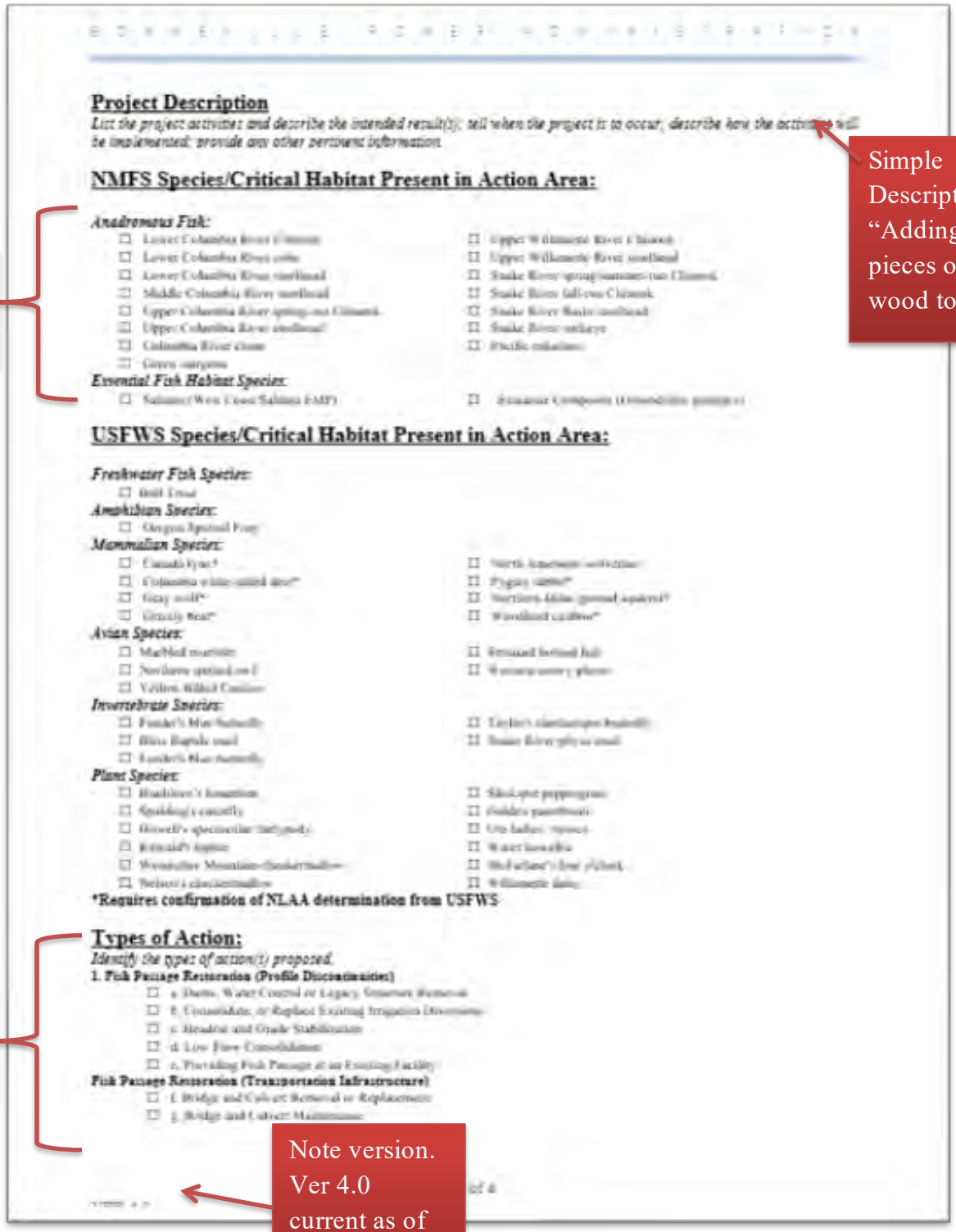
Please refer to HIP No# when discussing project.

Consultation Numbers

Note Project Completion Form (PCF) Due Date

Simplified Form

Note that PNF and PCF must be issued on a yearly basis (season by season) due to tracking requirements.



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.

NMFS Species/Critical Habitat Present in Action Area:

Anadromous Fish:

Essential Fish Habitat Species:

USFWS Species/Critical Habitat Present in Action Area:

Freshwater Fish Species:

Amphibian Species:

Mammalian Species:

Avian Species:

Invertebrate Species:

Plant Species:

***Requires confirmation of NLAA determination from USFWS**

Types of Action:

Identify the type of action(s) proposed.

1. Fish Passage Restoration (Profile Discontinuities)

Fish Passage Restoration (Transportation Infrastructure)

Species Affected Continued

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

Project Activity Categories

Note version. Ver 4.0 current as of 7/01/2020

- ☐ 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, Small Wood & Boulders)
- ☐ e. Riparian Vegetation Planting
- ☐ f. Channel Reconstruction
- ☐ g. Install Habitat Forming Materials (Sediment & Gravel)

3. Invasive and Non-Native Plant Control

- ☐ a. Manage Vegetation using Physical Controls
- ☐ b. Manage Vegetation using Herbicides (Riverine)
- ☐ c. Manage Vegetation using Herbicides (Estuarine)
- ☐ d. Manage *Ludwigia* using Herbicides (Willamette)
- ☐ e. Juniper Burning
- ☐ f. Prescribed Burning

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

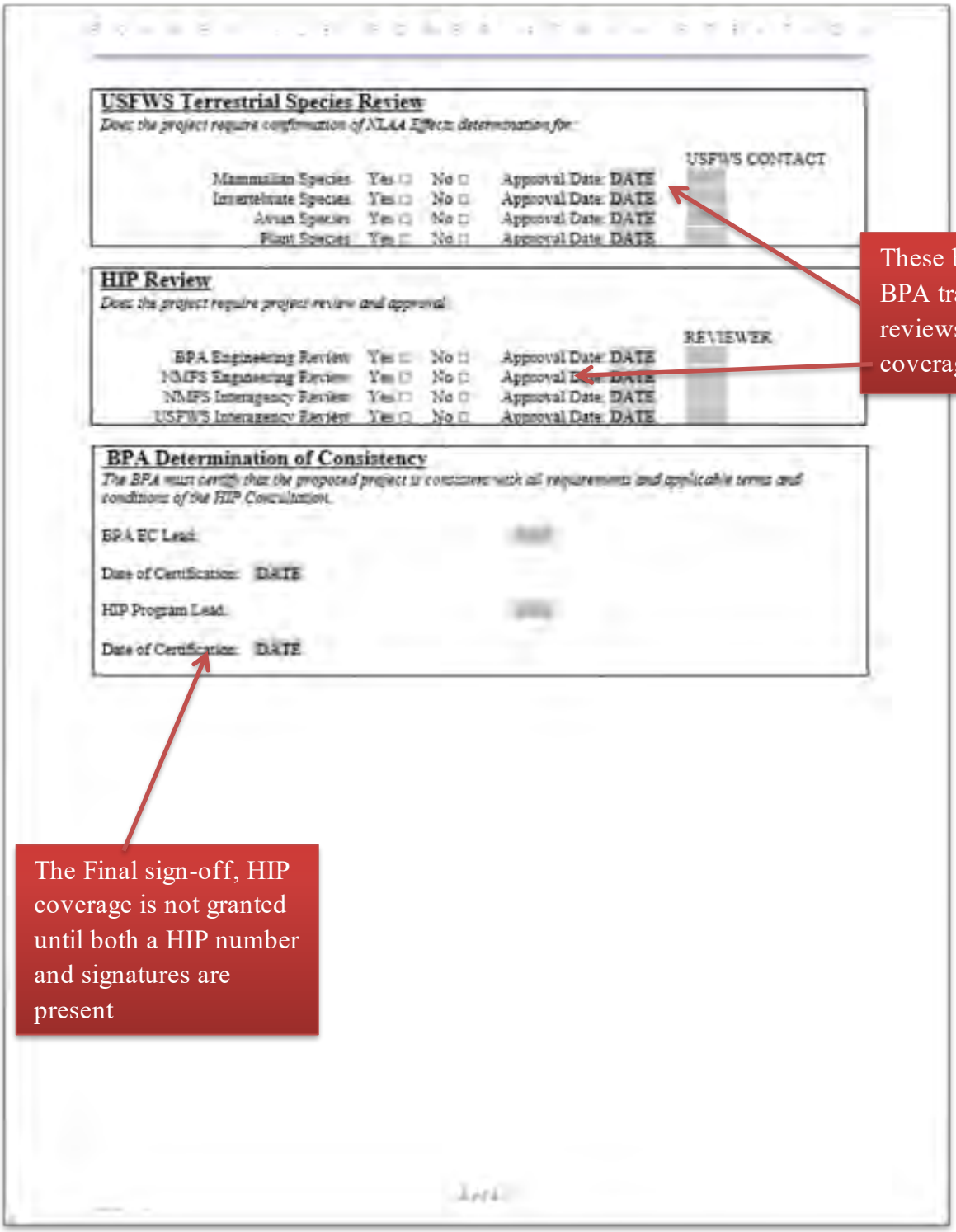
- ☐ Fisheries, Hydrologic, and Geomorphologic Surveys

9. Special Actions (Terrestrial Species)

- ☐ a. Install/develop Wildlife Structures
- ☐ b. Fencing Construction for Livestock Control
- ☐ c. Plant Vegetation
- ☐ d. Tree Removal for LW Projects
- ☐ g. Willamette Valley Prairie Restoration

Project Activity Categories

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



USFWS Terrestrial Species Review

Does the project require confirmation of NLAA Effects determination for:

USFWS CONTACT

Mammalian Species	Yes ☐	No ☐	Approval Date: DATE
Invertebrate Species	Yes ☐	No ☐	Approval Date: DATE
Avian Species	Yes ☐	No ☐	Approval Date: DATE
Plant Species	Yes ☐	No ☐	Approval Date: DATE

HIP Review

Does the project require project review and approval

REVIEWER

BPA Engineering Review	Yes ☐	No ☐	Approval Date: DATE
NMFS Engineering Review	Yes ☐	No ☐	Approval Date: DATE
NMFS Interagency Review	Yes ☐	No ☐	Approval Date: DATE
USFWS Interagency Review	Yes ☐	No ☐	Approval Date: DATE

BPA Determination of Consistency

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

BPA EC Lead:

Date of Certification: DATE

HIP Program Lead:

Date of Certification: DATE

These boxes are where BPA tracks the different reviews required for coverage under the HIP

The Final sign-off, HIP coverage is not granted until both a HIP number and signatures are present

2.9 HIP Forms – Project Completion Form (PCF)

In most cases, every PNF must be followed by a PCF. The exceptions are for projects that are vegetation management only. They require a Herbicide Use Form (HUF)

HIP4

PROJECT COMPLETION FORM

HIP No:

Project Title:	**Click here to enter text.**		
Date of Submittal:	DATE		
BPA Project #:	Click here to enter text.	**Contract #:**	Click here to enter text.

Project Activity Start and End Dates:

Work Element	Project Activities	Start Date	End Date
	Click here to enter text.	DATE	DATE
	Click here to enter text.	DATE	DATE
	Click here to enter text.	DATE	DATE
	Click here to enter text.	DATE	DATE
	Click here to enter text.	DATE	DATE

Fish Capture Reporting

The BPA will report the following information for all projects that involve work area isolation with associated fish capture and relocation. When available, provide a tally of ESA-listed salmonids by species (salmon or steelhead) and life stage.

Fish Capture Lead (name, contact info)	Click here to enter text.

	Interior Columbia Basin	Lower Columbia (Hood River downstream)	Bull Trout
Captured	Click here to enter text.	Click here to enter text.	Click here to enter text.
Killed	Click here to enter text.	Click here to enter text.	Click here to enter text.

3 of 2

Fish Capture reporting, if the mortality is more than 5% please provide an explanation.

Turbidity Reporting

The Project Sponsor shall complete and record the following water quality observations to ensure that any increase in suspended sediment is not exceeding the limit for HIP compliance.

Monitoring Lead (name, contact info)	Click here to enter text.

Work Element	Date	+4 hrs	+8 hrs	+ 12 hrs	+16 hrs	COMMENTS – if turbidity was visible at interim checks, how was work modified to reduce turbidity? What special circumstances led to exceedance?

Instructions: Establish your visual observation points. First one approximately 100 ft up-stream in undisturbed water. The second one down stream of work site at the following distances from the project area.

- 50 feet in streams that are 30 feet wide or less.
- 100 feet in streams between 30 and 100 feet wide.
- 200 feet in streams greater than 100 feet wide.
- 300 feet for areas subject to tidal or coastal scour.

Upon the start of the project, if the downstream observed turbidity visibly exceeds background levels modify/add BMPs and continue to monitor every 4 hours. If exceedance continues for second monitoring interval (2 intervals in a row, 8 hours) STOP WORK until turbidity resumes to background. Work may resume once turbidity reaches background levels.

Turbidity monitoring exceedances must be explained.

Narrative Assessment

Provide a narrative assessment of the project sponsor's success in meeting all HIP requirements. Please include:

- Photos of habitat conditions before, during, and after action completion.
- Evidence of compliance with fish screen criteria, for any pump used in fish-bearing waters.
- A summary of the results of pollution and erosion control inspections, including any erosion control failure, turbidity in exceedance of HIP standards, contaminant release, and correction effort.
- A description of the post-project condition of any riparian area cleared within 150 feet of Ordinary High Water.
- A description of site restoration completed and future site restoration plans.
- A description of any project activities that were not implemented or differ from what was proposed.
- Any issues that were encountered during implementation or lessons learned.

Before and After photopoints tell a good story.

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 State and Federal Permits

A. All applicable regulatory permits and official authorizations will be obtained by the Sponsor before project implementation.

B. These permits and authorizations include, but are not limited to, National Environmental Policy Act (NEPA), National Historic Preservation Act, appropriate state agency removal and fill permits, USACE Clean Water Act (CWA) 404 permits, CWA Section 401 water quality certifications, FEMA no-rise analyses.

3.1.1.2 Timing of in-water work

A. 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. A maximum of one week past the recommended in-water work window shall be considered and approved by the BPA EC Lead.

B. The regional state biologist shall approve changes exceeding one week to in-water work.

C. 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 applied to minimize project effects.

D. 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 LTW 2020[1], or most recent guidance. Salvage should include salvage of larval lamprey from sediments. See conservation measures for fish salvage and electrofishing.

E. The final project in-water work window shall be indicated in the project drawings.

3.1.1.3 Contaminants

A. The Project Sponsor will complete a site assessment 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.

B. The site assessment, stored with the project files, will summarize:

1. The site visit, condition of property, and identification of areas used for various industrial processes;
2. Available records, such as former site use, building plans, and records of any prior contamination events;
3. Interviews with knowledgeable people, such as site owners, operators, and occupants, neighbors, or local government officials; and
4. The type, quantity, and likelihood of potential contaminants and sources present at the site.

3.1.1.4 Site layout and flagging

A. The project area will be clearly flagged prior to construction.

B. Areas to be flagged include:

1. Sensitive resource areas, such as areas below ordinary high water (OHW), spawning areas, springs, and wetlands;
2. Equipment entry and exit points;
3. Road and stream crossing alignments;
4. Staging, storage, and stockpile areas; and
5. No-herbicide-application areas and buffers.

3.1.1.5 Temporary access roads and paths

A. 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.

[1] Lamprey Technical Workgroup. 2020. Best management guidelines for native lampreys during in-water work. Original Version 1.0, May 4, 2020. 26 pp. + Appendices.
Available: https://www.fws.gov/pacificlamprey/LTWGMainpage.cfm

B. Vehicle use and human activities, including walking in areas occupied by terrestrial ESA-listed species, will be minimized.

C. 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.

D. 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).

E. At project completion, all temporary access roads and paths will be obliterated and the soil will be stabilized and revegetated. Road and path obliteration refers to the most comprehensive degree of decommissioning and involves decompacting the surface and ditch, pulling the fill material onto the running surface and reshaping to match the original contour.

F. 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.

3.1.1.6 Temporary stream crossings

A. Existing stream crossings, fords, or bedrock will be used whenever possible, and the number of temporary stream crossing will be minimized.

B. 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.

C. For projects that require equipment and vehicles to cross in the wet:

1. The location and number of all wet crossings must be approved by BPA and clearly indicated on design drawings;
2. Vehicles and machinery will cross streams at right angles to the main channel wherever possible;
3. No stream crossings will occur 300 feet upstream or 100 feet downstream of an existing redd or spawning fish; and
4. After project completion, temporary stream crossings will be obliterated, and the banks restored.

3.1.1.7 Staging, storage, and stockpile areas

A. 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 or spill prevention measures are approved by the BPA EC Lead.

B. 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.

C. 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.

D. 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.

3.1.1.8 Equipment

A. 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).

B. Equipment will be stored, fueled, and maintained in a clearly identified staging area that meets staging area conservation measures.

C. 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);

D. Biodegradable lubricants and fluids[2] shall be used on equipment operating in the stream channel and live water.

E. Inspected daily for fluid leaks before leaving the vehicle staging area for operation within 150 feet of any natural water body or wetland; and

F. Thoroughly cleaned before operation below ordinary high water (OHW), and as often as necessary during operation, to remain free of grease.

[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.

3.1.1.9 Erosion control

A. Erosion control best management practices (BMPs) will be prepared and carried out, commensurate with the scope of the action. Temporary erosion control measures include:

1. 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.
2. 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.
3. 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.
4. 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.
5. Sediment will be removed from erosion control once it has reached 1/3 of the exposed height of the control.
6. Once the site is stabilized following construction, temporary erosion controls will be removed.

B. Emergency erosion controls. 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.

3.1.1.10 Dust abatement

A. 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:

B. Work will be sequenced and scheduled to reduce exposed bare soil subject to wind erosion.

C. 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.

D. 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).

E. Spill containment equipment will be available during application of dust abatement chemicals.

F. Petroleum-based products will not be used for dust abatement.

3.1.1.11 Spill prevention, control, and counter measures

A. A description of hazardous materials (fuel, lubricants, hydraulic fluid[3], or other contaminants) that will be used, including inventory, storage, and handling procedures, will be available on-site.

B. Written procedures for notifying environmental response agencies will be posted at the work site.

C. 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.

D. Workers will be trained in spill containment procedures and will be informed of the location of spill containment kits.

E. 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.

F. Pumps used adjacent to water shall use spill containment systems.

3.1.1.12 Invasive species control

A. 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.

B. Watercraft, waders, boots, and any other gear to be used in or near water will be inspected for aquatic invasive species.

C. 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 have been approved by the EC Lead.

[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.

3.1.2 Work Area Isolation & Fish Salvage

3.1.2.1 Work Area Isolation

A. 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 an approval from a NMFS habitat biologist may be pursued.

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

C. 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 2011[4], or most current). Wider mesh screens may be used after all fish have been removed from the isolated area.

D. Work area isolation and fish capture activities 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.

3.1.2.2 Fish Salvage

A. Monitoring and recording will take place for the duration of salvage activities. The salvage report will be communicated to the Agencies via the project completion form (PCF).

B. Salvage activates should take place during conditions to minimize stress to fish species, typically periods of the coolest air and water temperatures which occur in the morning versus late in the day.

C. A fish biologist will determine an operational plan 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. Salvage operations will follow the ordering, methods, and conservation measures specified as follows:

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

1. Slowly reduce water from the work area to allow some fish to leave the work area volitionally. 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 electrofishing conservation measures.
2. Block nets will be installed at upstream and downstream locations and maintained in a secured position to exclude fish from entering the project area.
3. 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 as long as passage requirements are met.
4. Nets will be monitored hourly anytime there is instream disturbance.
5. 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.
6. Capture fish through seining, and relocate to streams.
7. While dewatering, any remaining fish will be collected by hand or dip nets.
8. Seines with a mesh size to ensure capture of the residing ESA-listed fish will be used.
9. Minnow traps may be left in place overnight and used in conjunction with seining.
10. Electrofish to capture and relocate fish not caught during seining. This step is to be used as a last resort; after all passive techniques have been exhausted. See electrofishing conservation measures.
11. Continue to slowly dewater the stream reach.
12. Collect any remaining fish in cold-water buckets and relocate to the stream;
13. Limit the time fish would be in a transport bucket, and release them as quickly as possible.
14. The number of fish within a bucket will be limited, and fish will be of relatively comparable size to minimize predation.
15. 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.
16. Buckets will be kept in shaded areas; or if in exposed areas, covered by a canopy.
17. Dead fish will not be stored in transport buckets but will be left on the streambank to avoid mortality counting errors.

D. In areas occupied by bull trout, lamprey, mussels[5], or native fish, the following salvage guidelines shall be met. See USFWS 2010, "Conservation Measures for Salvage of Native Fish, Lamprey and Mussels" (LTW 2020[6]) and guidance developed by the Xerces Society (Blevins et al. 2018, 2019) or most recent guidance for additional information. Salvage guidelines are as follows:

1. Conduct native mussel and lamprey presence and absence surveys; approximate numbers for salvage to aid in planning for salvage.
2. Pre-select site(s) for release and/or mussel bed relocation.
3. Salvage of bull trout will not take place when water temperatures exceed 15 degrees Celsius.
4. If drawdown less than 48 hours, salvage of lamprey and mussels may not be necessary if temperatures support survival in sediments.
5. Salvage mussels by hand after 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.
6. Salvage lamprey by electrofishing. See electrofishing conservation measures for lamprey and larval lamprey dry shock settings.
7. Salvage bony fish after lamprey with nets or electrofishing (see electrofishing conservation measures for appropriate settings).
8. Regularly inspect dewatered site since lamprey likely to emerge and mussels may become visible after dewatering.
9. Mussels may be transferred in coolers.
10. Mussels will be placed individually to ensure ability to burrow into new habitat.

3.1.2.3 Electrofishing Based on NMFS's Electrofishing Guidelines (NMFS 2000[7])

A. Initial Site Surveys and Equipment Settings

1. 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.
2. Prior to the start of sampling at a new location, water temperature and conductivity measurements shall be taken to evaluate electrofisher settings and

[5] For mussels, 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/

[6] Lamprey Technical Workgroup. 2020. Best management guidelines for native lampreys during in-water work. Original Version 1.0, May 4, 2020. 26 pp. + Appendices.
Available: https://www.fws.gov/pacificlamprey/LTWGMainpage.cfm

[7] https://www.fisheries.noaa.gov/resource/document/additional-agency-guidance

adjustments. 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.

3. Whenever possible, a block net should be placed below the area being sampled to capture stunned fish that may drift downstream.
4. Each electrofishing session must start with all settings (voltage, pulse width, and pulse rate) set to the minimums needed to capture fish (Table 1).
5. 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. Records for conductivity, water temperature, air temperature, electrofish settings, electrofisher model, electrofisher calibration, fish conditions, fish mortalities, and total capture rates shall be included in the salvage log book.

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

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

B. Electrofishing Technique

1. 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 while remaining below maximum levels.
2. Maximum voltage will be 1100 volts when conductivity is less than 100 milliseconds, 800 volts when between 100 and 300 milliseconds, and 400 volts when less than 300 milliseconds (Table 1).
3. 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) within maximum values (Table 1).
4. Maximum pulse width is 5 milliseconds. Maximum pulse rate is 70 hertz.
5. Electrofishing will not occur in one area for an extended period. 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. 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.
6. The anode should not intentionally contact fish. The zone of potential injury for fish of 0.5 m from the anode shall be avoided.
7. Settings will be lowered in shallower water since voltage gradients are likely to increase.
8. Electrofishing will not occur in turbid water where visibility is poor (i.e. unable to see the bed of the stream).
9. 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. 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.

C. Sample Processing

1. Fish shall be sorted by size to avoid predation during containment.
2. Samplers must be aware of the conditions in the containers holding fish; air pumps, water transfers, etc. to maintain safe conditions. All sampling procedures must have a protocol for protecting held fish.
3. Fish should be observed for general condition and injuries (e.g., increased recovery time, dark bands, and visually observable spinal injuries).
4. Fish should be processed as soon as possible after capture to minimize stress. This may require a larger crew size. 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. Every attempt should be made to process and release ESA-listed specimens first.

D. Bull Trout Electrofishing Conservation Measures
    1. For salvage operations in known bull trout spawning and rearing habitat[8], electrofishing shall only occur from May 1 to July 31. In FMO[9] 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.

E. 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 BPA EC Lead and prioritize protections towards the ESA-listed fish. Verify electrofisher model with EC Lead if not one of the following:
        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.
    2. 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 (Table 2).
    3. 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). Use a pattern of 3 slow pulses followed by a skipped pulse (bursted pulse) helps larval lampreys to emerge.
    4. 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. Avoid exposing larval lampreys to extended periods of electrofishing as it has also been linked to electronarcosis. Recovery from electronarcosis takes about 15 minutes.
    5. 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.

[8] Bull Trout Spawning and Rearing habitat is not foraging, migrating, and overwintering (FMO) habitats.
[9] Bull Trout Spawning and Rearing habitat is not foraging, migrating, and overwintering (FMO) habitats.

6. 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.
7. 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.
8. 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).

Table 2: Electrofishing Guidelines for Larval Lampreys.

	"Tickle" Bursted Slow Pulse Primary Way 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	60-90 seconds	


CAT

3.1.2.4 Dewatering

A. 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.

B. Diversion around the construction site may be accomplished with a cofferdam and a by-pass 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.

C. 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.

D. Dissipation of flow energy at the bypass outflow will be provided to prevent damage to riparian vegetation and/or stream channel.

E. 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.

3.1.3 Construction and Post-Construction Conservation Measures

3.1.3.1 Fish passage

A. 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, or if it shall increase negative effects on ESA-listed species or their habitat.

B. Fish passage alternatives shall be approved by BPA EC lead under advisement by NMFS habitat biologist.

3.1.3.2 Construction and discharge water

A. Surface water may be diverted to meet construction needs, but only if developed sources are unavailable or inadequate.

B. Diversions will not exceed 10% of the available flow.

C. All construction discharge water will be collected and treated using the best available technology suitable for site conditions. Treatments to remove debris, nutrients, sediment, petroleum hydrocarbons, metals and other pollutants likely to be present will be provided.

3.1.3.3 Time and extent of disturbance

A. 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.

B. 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

A. Project operations will cease when high flow conditions may result in inundation of the project area, except for efforts to avoid or minimize resource damage.

B. Project operations will cease when allowable water quality levels are exceeded as defined by the state CWA section 401 water quality certification or HIP Turbidity Monitoring Protocol. See CWA Section 401 Water Quality Certification for more information.

3.1.3.5 Site restoration

A. All streambanks, soils, and vegetation will be cleaned up and restored as necessary using stockpiled large wood, topsoil, and native channel material.

B. All project-related waste will be removed.

C. 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.

D. 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

A. Planting and seeding will occur prior to or at the beginning of the first growing season after construction.

B. 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.

C. 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.

D. 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.

E. Surface fertilizer will not be applied within 50 feet of any stream channel, waterbody, or wetland.

F. Fencing will be installed as necessary to prevent access to revegetated sites by livestock or unauthorized persons.

G. Invasive species will not be used. Invasive plants will be removed or controlled until native plant species are well-established (typically within 3 years post-construction to achieve 70% of pre-project conditions).

3.1.3.7 Site access and implementation monitoring

A. 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. Project Sponsor staff or their designated representative will provide implementation monitoring to ensure:

   a. General conservation measures are adequately followed.

   b. Effects to listed species are not greater than predicted and incidental take limitations are not exceeded.

   c. Turbidity monitoring is being conducted in accordance with the HIP turbidity monitoring protocol.

B. The Project Sponsor or designated representative will submit the Project Completion Form (PCF) to ensure compliance with the applicable BiOp.

3.1.3.8 CWA section 401 water quality certification

A. The Project Sponsor or designated representative will complete and record water quality observations to ensure that in-water work is not degrading water quality.

B. 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 and Conservation Measures

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

B. The following will be applied to all rewatering efforts. Complex rewatering may require additional notes or a dedicated sheet in the construction details.

1. Turbidity monitoring protocol will be applied to rewatering efforts.
2. Pre-wash the newly-excavated channel before rewatering[10]. 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.
3. Install seine nets at upstream end to prevent fish from moving downstream until 2/3 of total flow is restored to the channel.
4. Starting in the early morning, introduce 1/3 of the flow into the new channel over a period of 1-2 hours.
5. Introduce the second 1/3 of the flow over the next 1-2 hours. Salvage fish from the old 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.
6. 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.
7. 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.
8. Install plug to block flow into old channel or bypass if not part of project. Remove any seine nets.
9. In lamprey systems, lamprey salvage and dry shocking may be necessary.

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

3.3 HIP Turbidity Monitoring Protocol and Conservation Measures

The Project Sponsor is responsible for monitoring turbidity during implementation. 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 the BPA EC Lead in advance of the likelihood of an exceedance and seek additional recommendations. Turbidity protocol is as follows:

A. Take a background turbidity measurement approximately 100 feet upstream from the project area using a recently-calibrated turbidimeter or estimated using visual observations (Figure 1). Note the turbidity level, location, and time of the background measurement.

B. Record the turbidity measured using a calibrated turbidimeter or estimated by visual observation **(**Figure 1) before work begins at the downstream point, known as the measurement compliance point. Note the turbidity level, location, and time. The compliance point shall be located downstream of the disturbance area, approximately:

    1. 50 feet downstream for streams that are less than 30 feet wide;
    2. 100 feet downstream for streams between 30 and 100 feet wide;
    3. 200 feet downstream for streams greater than 100 feet wide; and
    4. 300 feet from the discharge point or nonpoint source for locations subject to tidal or coastal scour.

C. Turbidity shall be measured by turbidimeter or estimated by visual observation (Figure 1) at the background and compliance points every **4 hours** while work is being implemented.

D. If there is a visible difference between a compliance point and the background then an exceedance (10% or more) has occurred and must be noted in the PCF. Adjustments or corrective measures must be taken in order to reduce turbidity.

E. If exceedances occur for more than **two consecutive monitoring intervals** (after 8 hours), the activity must stop until the turbidity level returns to background, and the BPA EC Lead must be notified after the project is concluded. The BPA 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.

F. 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).

G. The Project Sponsor shall submit a summary of readings, exceedances, control failures, adaptive measures to BPA using the HIP Project Completion Form (PCF).

Figure 1 Suggested Visual Observational Differences in Turbidity

NOTE: A visual observation of a difference between compliance points shall be assumed to be about a 10% increase in natural stream turbidity.

Chapter 4: Activity-Specific Conservation Measures

4.1 Category 1: Fish Passage Restoration

HIP provides ESA coverage for BPA funded 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.[11]

BPA has grouped passage projects according to their potential effects to ESA-listed species and risk-based review requirements into two subcategories: Profile Discontinuities and Transportation Infrastructure. The following activity categories address projects that improve Profile Discontinuities: (a) Dam, Water Control Structures, or Legacy Structure Removal; (b) Consolidation or Replacement of Existing Irrigation Diversions; (c) Headcut and Grade Stabilization; (d) Low Flow Consolidation; and (e) Provide Fish Passage at an Existing Facility. The following activity categories address Transportation Infrastructure projects: (f) Removal or Replacement of Bridges and Culverts; (g) Bridge and Culvert Maintenance; and (h) Installation of Fords.

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. These impacts would be evaluated in BPA's NEPA determination, but are not covered in HIP.

[11] *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).

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

Description

HIP provides ESA coverage for BPA funded fish passage projects that 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.

"Small dams" include instream structures with active channels less than 75 feet, and (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%[12] downstream, or (2) up to 16.4 feet in height for streams with a slope greater than 4%.

Guidelines for Risk

- ***Low Risk:*** Removal of structures such as subsurface drainage features, tide gates, outfalls, pipes, small dams with total head measurement less than 3 feet that do not require fish isolation or flow diversion during implementation (for example, an abandoned structure in the floodplain or intermittent and ephemeral channels).
- ***Medium Risk:*** Removal of instream structures less than 3 feet.
- ***High Risk:*** Removal of small dams greater than or equal to 3 feet and less than 15 feet in height for streams with a slope less than 4%, or greater than 3 feet and less than 16.4 feet in height with a slope greater than 4%.

[12] Measured over 10 bankfull widths upstream and 10 bankfull widths downstream

Guidelines for Review

- BPA Functional review required for all risk levels.
- BPA Technical review required for medium and high risk projects.
- NMFS Engineering review required for all instream barriers greater than or equal to 3 feet.
- Interagency review required for high risk projects.
- USFWS Field Office Supervisor review required if passage improvement increases connectivity between bull trout and non-native species.

Conservation Measures

1) 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 shall adhere to appropriate conservation measures for all activities in Category 2: River, Stream, Floodplain, and Wetland Restoration.
2) Tide gates can only be removed, but not modified or replaced, under this activity category. See activity category 2b) Set-back or Removal of Existing Berms, Dikes and Levees for tide gate relocation.
3) 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.[13] 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 activity category 1c) Headcut and Grade Stabilization.
4) 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 from the upstream and downstream boundaries of the project.
5) Sediment characterization must be performed and demonstrate the proportion of coarse sediment (>2mm) stored 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.

[13] 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

6) Estimate volume of potentially mobile material and perform an assessment of potential downstream impacts. Surveys must be taken of any downstream spawning areas that may be affected by sediment released due to removal of the water control structure or dam.

7) Following removal of the structure, restore all bank lines and fill in all holes with native materials to natural 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 substantial disruption to riparian vegetation and/or the floodplain, consider leaving the buried structure sections within the streambank.

8) If the structure is being removed because it has caused an over-widening of the channel, consider implementing other HIP 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.

4.1.2 Category 1b) Consolidate or Replace Existing Irrigation Diversions

Description

HIP provides ESA coverage for BPA funded 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.

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

The installation of new lay-flat stanchions is not covered under HIP.

Guidelines for Risk

- ***Low Risk:*** N/A, see Section 2.4 Risk Determination for low risk consideration.
- ***Medium Risk:*** Replacement of irrigation diversion structures less than 3 feet in height.
- ***High Risk:*** Removal or replacement of irrigation diversion structures greater than or equal to 3 feet in height.

Guidelines for Review

- BPA Functional review required for all risk levels.
- BPA Technical review required for all instream diversions.
- NMFS Engineering review required for all instream diversions greater than or equal to 3 feet or for diversions greater than or equal to 3 cfs.
- Interagency review required for high risk projects.
- USFWS Field Office Supervisor review required if passage improvement increases connectivity between bull trout and non-native species.

Conservation Measures

1) If structures are removed, see activity category 1a) Dams, Water Control Structures, or Legacy Structures Removal for appropriate conservation measures.
2) If placement of rock structures or engineered riffles is required for headcut or grade stabilization, see activity category 1c) Headcut and Grade Stabilization for appropriate conservation measures.
3) If fish exclusion is added or modified, see activity category 7g) Install, Upgrade, or Maintain Fish Exclusion Devices and Bypass Systems for appropriate conservation measures.
4) Diversion structures shall be designed to meet NMFS Anadromous Salmonid Passage Facility Design Guidelines (NMFS 2011 or more recent version)[14] and, where appropriate, *Guidelines for incorporating adult Pacific lamprey passage at fishways (PLTW 2017)*[15].
5) Irrigation diversion intake and return points will be designed or replaced to prevent ESA listed and threatened fish species from swimming or being entrained in the irrigation system.
6) For irrigation efficiency and water conservation actions within this activity category, HIP will only cover projects that use state-approved regulatory mechanisms (e.g., Oregon

[14] 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

[15] *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).

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 substantial loss of the instream flows to downstream diversions.

7) 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.

8) 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.

9) 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:
    a. Incorporation of a restricted orifice plate or screen at the POD that provides at a maximum, the required area to pass the irrigators water right;
    b. Mechanically restricting the opening of a variable head gate to the maximum area required to pass the irrigator's water right; or
    c. Any other method that will satisfy the intent of the diversion flow governance requirement that can be justified by the design documents.

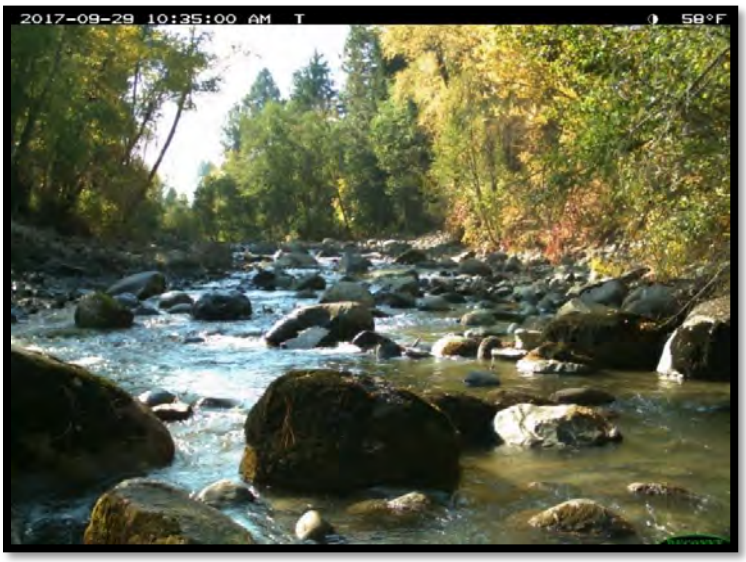
10) Treated wood and copper- or zinc-plated hardware shall not be used in the construction of irrigation diversions. ASTM A615 and/or black steel hardware (or approved similar steels) shall be used. Concrete must be sufficiently cured or dried (48-72 hours depending on temperature) before coming into contact with stream flow.

4.1.3 Category 1c) Headcut and Grade Stabilization

Description

HIP provides ESA coverage for BPA funded restoration of fish passage and grade control (i.e., headcut and grade stabilization) with geomorphically-appropriate structures. Structures may include engineered riffles, rock weirs, log weirs, and large wood (LW). 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.

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. Unlike hard weirs or rock grade control structures, a grade control ELJ is a complex broad-crested structure that dissipates energy more gradually.



Guidelines for Risk

- ***Low Risk:*** N/A, see Section 2.4 Risk Determination for low risk consideration.
- ***Medium Risk:*** Grade control structures that address headcuts less than 18 inches in height as measured from the streambed (18 inches refers to the total height of the headcut(s), rather than height of individual structures).
- ***High Risk*****:** Grade control structures that address headcuts greater than or equal to 18 inches in height as measured from the streambed (18 inches refers to the total height of the headcut(s), rather than height of individual structures).

Guidelines for Review

- BPA Functional review required for all risk levels.
- BPA Technical review required for medium and high risk levels.
- NMFS Engineering review required for headcut or grade stabilization actions greater than or equal to 18 inches in height.
- Interagency review required for high risk projects.
- USFWS Field Office Supervisor review required if passage improvement increases connectivity between bull trout and non-native species.

Conservation Measures (General)

1) All structures will be designed to the design benchmarks set forth in NMFS 2011 [16] (or most recent version).
2) For grade control structures that are greater than or equal to 18 inches in height, provide the profile of the stream thalweg for a minimum for of (10) upstream and (10) downstream channel widths beyond the extent of the proposed construction. The design documentation shall provide enough information to clearly demonstrate project impacts to the stream channel and the potential for channel degradation.

Conservation Measures (Boulder and log weirs)

1) For the use of wood, see additional conservation measures in activity category 2d) Install Habitat-Forming Instream Structures (Large Wood, Small Wood and Boulders).
2) Install 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).
3) Weirs are to be placed perpendicularly 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.
4) 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.
5) 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.
6) 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.
7) Material used to construct weirs shall be durable and of suitable quality to ensure permanence in the climate in which it is to be used.

[16] 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

8) For boulder weirs, the use of gabions, cable, or other mechanical connections to prevent the movement of individual boulders in a weir are not allowed.

Conservation Measures (Headcut stabilization and roughened riffles)

1) Provide fish passage over stabilized head-cut or constructed riffle according to NMFS 2011[17] (or most recent version). Passage can be provided through a series of log or rock weir structures or a roughened channel.
2) Armor features intended for grade stabilization with sufficiently-sized and amounts of material to provide a structure capable of withstanding a 100-year flow event (or other approved design flow) without further progressing the headcut or substantially degrading the riffle.
3) Headcut stabilization structures and roughened riffles will be constructed utilizing an engineered 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) For grade stabilization efforts, design considerations should extend beyond the control structure to include the plunge pool downstream and the upstream approach. Also consider floodplain return flows and flanking that could create potential new headcut conditions, and potential changes in bank erosion conditions due to structure placement.
5) Minimize lateral migration of the channel around the head cut or riffle ("flanking") by designing the downstream face with a lower elevation in the center of the channel cross section to direct flows to the middle of channel.
6) Materials used for construction can be native to the area if gradation is shown to be appropriate.

[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

4.1.4 Category 1d) Low Flow Consolidation

Description

HIP provides ESA coverage for BPA funded 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 Risk

- ***Low Risk:*** N/A, see Section 2.4 Risk Determination for low risk consideration.
- ***Medium Risk:*** All low flow consolidation activities.
- ***High Risk*:** N/A, see Section 2.4 Risk Determination for high risk considerations.

Guidelines for Review

- BPA Functional review required for all risk levels.
- BPA Technical review required for medium and high risk levels.
- NMFS Engineering review required for all low flow consolidation activities.
- Interagency review required for high risk projects.
- USFWS Field Office Supervisor review required if passage improvement increases connectivity between bull trout and non-native species.

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 2017[18].
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.

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

4.1.5 Category 1e) Provide Fish Passage at an Existing Facility or Existing Obstruction

Description

HIP provides ESA coverage for BPA funded projects that: (a) re-engineer fish passage or fish collection facilities that are improperly designed; (b) perform periodic maintenance of fish passage or fish collection facilities to ensure proper functioning (e.g., cleaning debris buildup, replacement of parts); and (c) install a new fish ladder at an existing facility or existing obstruction (beaver dam, etc.).

Guidelines for Risk

- ***Low Risk:*** Periodic Maintenance of fish passage or fish collection facilities.
- ***Medium Risk:*** Re-engineering improperly-designed fish passage or fish collection facilities, installation of a fish ladder at an existing facility, or other activities for total head differences less than 3 feet.
- ***High Risk:*** Re-engineering improperly-designed fish passage or fish collection facilities, installation of a fish ladder at an existing facility, or other activities for total head differences greater than or equal to 3 feet.

Guidelines for Review

- BPA Functional review required for all risk levels.
- BPA Technical review required for medium and high risk projects.
- NMFS Engineering Review required for new installation and modifications to fish passage structures.
- Interagency review required for high risk projects.
- USFWS Field Office Supervisor review required if passage improvement increases connectivity between bull trout and non-native species.

Conservation Measures

1) For maintenance activities where sediment is placed in stream, see activity category 2g) Install Habitat-Forming Natural Materials (Sediment and Gravel) for appropriate conservation measures.
2) Fish Passage will be designed to the design benchmarks set forth in NMFS 2011[19] (or most recent version).
3) Design consideration should be given for Pacific lamprey passage, as described in guidelines set forth in Pacific Lamprey Technical Workgroup 2017[20]. 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.
4) Treated wood and copper- or zinc-plated hardware shall not be used in the construction of fish ladders. ASTM A615 and/or black steel hardware (or approved similar steels) shall be used. Concrete must be sufficiently cured or dried[21] before coming into contact with stream flow.

[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.

4.1.6 Category 1f) Bridge and Culvert Removal or Replacement

Description

HIP provides ESA coverage for BPA funded bridge and culvert removals and replacements. 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)
3) Closed bottom culvert (designed by the streambed simulation design method or the no-slope method)

New bridges and culverts can only be built when an existing crossing was present. An existing crossing may be relocated to benefit habitat.

Guidelines for Risk

- ***Low Risk:*** N/A, see Section 2.4 Risk Determination for low risk consideration.
- ***Medium Risk*:** All culverts and bridges are considered medium risk.
- ***High Risk:*** N/A, see Section 2.4 Risk Determination for high risk consideration.

Guidelines for Review

- BPA Functional review required for all risk levels.
- BPA Technical review required for medium and high risk projects.
- NMFS Engineering Review required for structures that do not meet 1.5 times bankfull width.
- Interagency review required for high risk projects.
- USFWS Field Office Supervisor review required if passage improvement increases connectivity between bull trout and non-native species.

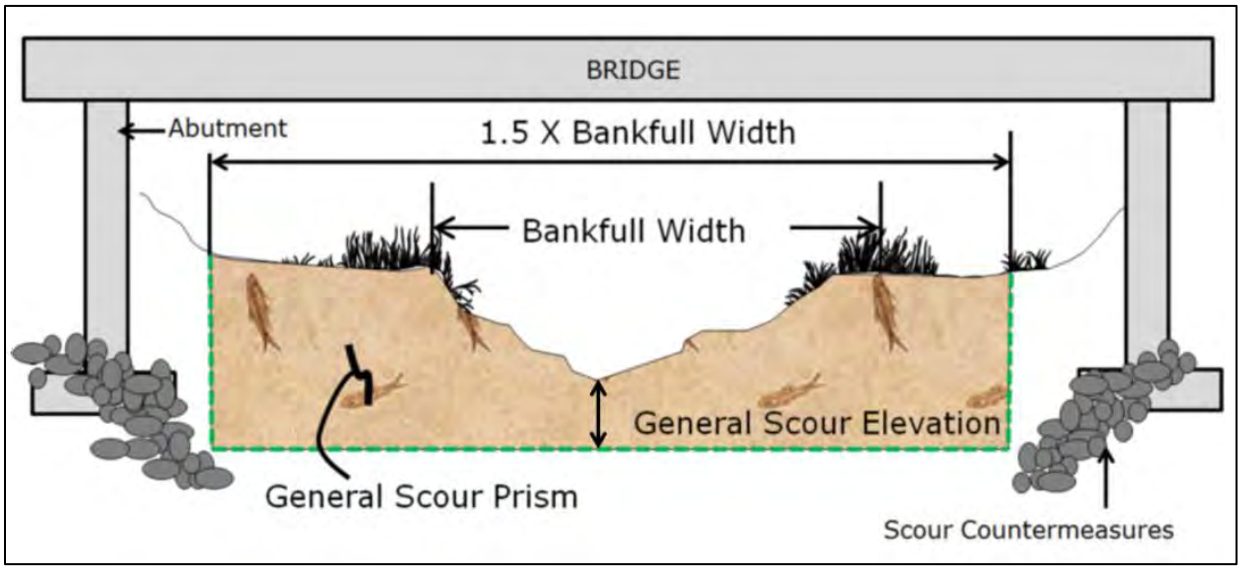
Conservation Measures

1) For bridges or culverts that require grade control, see additional conservation measures in activity category 1c) Headcut and Grade Stabilization. The Project Sponsor shall include suitable grade controls to prevent passage failure caused by changes in stream elevation. Grade control structures to prevent headcutting should be placed above or below the culvert or bridge and may be built using rock or wood.
2) Bridges and open bottom culverts must be designed so they are wide enough to maintain a clear, unobstructed opening during events that approximate a 2-year flow event.
    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).

3) 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.

Figure 2 Bridge Scour Prism Illustration[22]



4) Bridge scour and stream stability countermeasures may **not** be applied within the general scour prism (the brown shaded area in Figure 2). For guidance on how to calculate general scour refer to page 66 of this handbook.

5) Reshape streambanks in a manner that does not create a velocity that differs from upstream and downstream conditions for flows up to 2-year flow event.

6) Stream fill materials within the general scour prism shall 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).

7) Design plans must include a construction note requirement to wash fines to seal bed properly and prevent flows from going subsurface.

8) 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.

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

9) Projects in channels with gradients above six percent will utilize a bridge or open bottom culvert.

10) 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 closed bottom 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.

11) The length for bridges and culverts utilizing the streambed simulation method should be less than 150 feet.

12) Structure material must be concrete, metal, or untreated wood. Concrete must be sufficiently cured or dried[23] before coming into contact with stream flow. The use of treated wood for bridge construction or replacement is not allowed.

13) Remove unused bridge supports down to an elevation below the total scour depth.

14) If relief conduits are necessary, then they should pass through existing fill.

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

Guidelines for Design - Determining Bankfull Width

Bankfull width is a primary parameter when designing passable bridges and culverts that meet the intent of HIP in alluvial streams. Accurately determining and measuring bankfull width and providing supporting documentation are critical for ensuring program success. To the extent practicable, bankfull width shall be determined in a local reference reach that is unaffected by existing bridges or infrastructure. BPA adopts the bankfull width determination and measurements methods described in Appendix C of the 2013 Washington Dept. of Fish and Wildlife *Water Crossing Design Guidelines*[24]. The bankfull width determination process and considerations, when used for design, shall be documented in the Basis of Design Report.

Guidelines for Design - 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 (Vc) needed to move the streambed material. The bankfull depth (y) is determined from hydraulic model results for the 2-year flow event. The

[24] (https://wdfw.wa.gov/sites/default/files/publications/01501/wdfw01501.pdf)

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 D50 particle size should be defined from the project-reach-specific pebble count.

Equation #1

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

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 (ds) below the streambed elevation. The bankfull depth (y) and the critical velocity (Vc) are taken from Equation #1 above. The mean velocity (Vm) is determined from hydraulic model results for the 2-year flow event.

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.

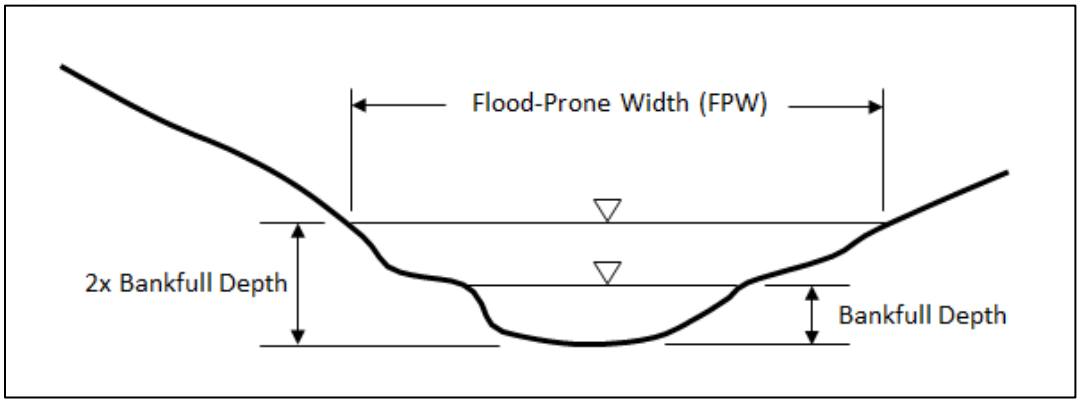
Guidelines for Design - Calculating Entrenchment Ratios

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)[25].

- 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.

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

4.1.7 Category 1g) Bridge and Culvert Maintenance

Description

HIP provides ESA coverage for BPA funded bridge and culvert maintenance projects that address the redress, or return, of a bridge or culvert to its as-built conditions. Maintenance to include removal of sediment and debris.

Guidelines for Risk

- ***Low Risk:*** Culverts and bridge maintenance is a low-risk activity.
- ***Medium Risk:*** **N/A**
- ***High Risk:*** **N/A**

Guidelines for Review

- BPA Functional review required for all risk levels.
- BPA Technical review not required.
- NMFS Engineering review not required.
- Interagency review not required.

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.

4.1.8 Category 1h) Installation of Fords

Description

HIP provides ESA coverage for BPA funded fords that 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 Risk

- ***Low Risk:*** N/A, see Section 2.4 Risk Determination for low risk consideration.
- ***Medium Risk:*** All fords shall start as medium risk.
- ***High Risk:*** N/A, see Section 2.4 Risk Determination for low risk consideration.

Guidelines for Review

- BPA Functional review required for all risk levels.
- BPA Technical review required for medium and high risk.
- NMFS Engineering review not required.
- Interagency review required for high risk.
- USFWS Field Office Supervisor review required if passage improvement increases connectivity between bull trout and non-native species.

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 impact of use and 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 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. All proposed vehicle fords shall be reviewed by an appropriate agency biologist.

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

HIP provides ESA coverage for BPA funded 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.

The following activity categories address projects that improve fish habitat: (a) Improve Secondary Channel and Floodplain Connectivity; (b) Set-back or Removal of Existing Berms, Dikes, and Levees; (c) Protect Streambanks Using Bioengineering Methods; (d) Install Habitat-Forming Instream Structures (Large Wood, Small Wood and Boulders); (e) Riparian and Wetland Vegetation Planting; (f) Channel Reconstruction; and (g) Install Habitat Forming Natural Materials (Sediment and Gravel).

4.2.1 Category 2a) Improve Secondary Channel and Floodplain Connectivity

Description

HIP provides ESA coverage for BPA funded restoration projects that increase floodplain hydrologic connectivity. Project may include:

- 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 floodplain and side channel habitats, which are maintained through natural processes.

Guidelines for Risk

- ***Low Risk:*** N/A, see Section 2.4 Risk Determination for low risk consideration.
- ***Medium Risk:*** Projects that require limited excavation to activate historic side channels and floodplains.
- ***High Risk:*** Projects that require substantial excavation. Projects that do not follow historic channel alignments.

Guidelines for Review

- BPA Functional review required for all risk levels.
- BPA Technical review required for medium and high risk.
- NMFS Engineering review is not required.
- Interagency review required for high risk projects.

Improve Secondary Channel and Floodplain Connectivity requires a Staged Rewatering Plan (Section 3.2).

Conservation Measures

1) Reconnection of historical fragmented habitats and increasing water surface elevations are preferred to excavation of newly constructed side channels in floodplains. Proposed new side channel construction must be within the historic floodplain (e.g. 5-year flow event), current channel meander migration zone, and require limited excavation for construction. Side channel excavation in floodplains connected less than the 5-year flow event shall meet conservation measures in activity category 2f) Channel Reconstruction.
2) Side channel creation with flows similar to the mainstem or depths greater than the mainstem shall meet conservation measures in activity category 2f) Channel Reconstruction.
3) Excavated natural materials should be placed instream if possible according to activity category 2f) Channel Reconstruction or 2g) Install Habitat Forming Natural Materials as appropriate. Any excess or unsuitable materials 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. Sediment to be placed in-water shall be assessed for contaminants per HIP section 3.1.1.2.
4) 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.
5) In the floodplain and intermittent side channels, adequate precautions will be taken to prevent the creation of fish passage issues or stranding that increase mortality of juvenile or adult fish. Stranding must be avoided by incorporating features that create shallow, slow-moving, water during flood stage that will not create large scour pools.
6) Side channels will be constructed to prevent fish stranding by providing a continual positive overall grade.
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) A protected riparian buffer strip of 35-feet associated with secondary channels and restored wetlands shall extend from the bankfull elevation towards the floodplain. An average riparian buffer can be applied to projects that are unable to achieve the 35-foot buffer in all areas or with a protection plan approved by the EC Lead.

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

Description

HIP provides ESA coverage for BPA funded restoration projects that remove 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 connectivity and function. 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 Risk

- ***Low Risk:*** N/A, see Section 2.4 Risk Determination for low risk consideration.
- ***Medium Risk:*** Projects that improve floodplain connectivity but do not significantly inundate new portions of the floodplain (less than 1 acre).
- ***High Risk:*** Projects that inundate substantial new portions of the floodplain (greater than or equal to 1 acre) currently cut off from the river.

Guidelines for Review

- BPA Functional review required for all risk levels.
- BPA Technical review required for medium and high risk.
- NMFS Engineering review required if tide gates are relocated.
- Interagency review required for high risk projects.

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) 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. Excavated natural materials should be placed instream if possible according to activity category 2f) Channel Reconstruction or 2g) Install Habitat Forming Natural Materials as appropriate. Sediment to be placed in-water shall be assessed for contaminants per HIP section 3.1.1.2.
3) When necessary, loosen compacted soils once overburden material is removed.
4) When substantial new portions of the floodplain are reconnected (greater than or equal to one acre) the project shall minimize fish stranding potential. Fish stranding potential and project consideration to minimize stranding shall be clearly demonstrated in the Basis of Design Report for review.
5) 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.
6) When a setback is required, setback locations should prioritize the functional floodplain and be placed outside of either the meander belt width or the channel meander zone margins.
7) When a setback is required, it is not allowed to provide more flood protection than the existing levee, no net rise. Hydraulic modeling shall be required to determine flood protection of existing levee.

4.2.3 Category 2c) Protect Streambanks Using Bioengineering Methods

Description

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

HIP provides ESA coverage for BPA funded projects that restore eroding streambanks through bank shaping; installation of soil reinforcements (e.g., coir logs, large wood, etc.) and other bioengineering techniques to support development of riparian vegetation; and/or planting of trees, shrubs, and herbaceous cover 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 as a subsidiary action to additional habitat restoration actions (e.g. channel reconstruction).

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 Risk

- ***Low Risk:*** N/A, see Section 2.4 Risk Determination for low risk consideration.
- ***Medium Risk:*** Streambank protection to start as medium risk.
- ***High Risk:*** See Section 2.4 Risk Determination for high risk consideration.

Guidelines for Review

- BPA Functional review required for all risk levels.
- BPA Technical review required for medium and high risk.
- NMFS Engineering review is not required.
- Interagency review required for high risk projects.

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) Bioengineering bank stabilization methods shall provide long term stabilization through self-sustaining vegetation. Projects should ideally use plantings and soil bioengineering for bank stabilization. Large wood should be used for stabilization as a method of last resort. Large wood may be added to create complexity and interstitial habitats when feasible.

3) 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.

4) 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.

5) Wood that is already within the stream or suspended over the stream may be repositioned to allow for greater interaction with the stream.

6) Large wood anchoring shall not utilize cable.

7) Treated wood, copper- or zinc-plated hardware shall not be used in construction of habitat features. ASTM A615 and/or black steel hardware (or approved similar steels) shall be used.

8) The utilization of structural connections (biodegradable rope or pins) should be used minimally. Structural connections for large wood shall only be used if hydraulic conditions warrant use. 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. Designs that use a structural connection shall be stamped by a licensed engineer.

9) Ballast (sediment, boulders, other logs) for structural stability of large wood shall only be used if hydraulic conditions warrant use. Rationale for structural ballast shall be justified and demonstrated in the Basis of Design Report and will be evaluated as a component of the HIP Technical Review. Designs that incorporate ballast shall be stamped by a licensed engineer.

10) Boulders shall not be used for streambank stabilization, except as ballast to stabilize large wood, unless it is necessary to prevent scouring or downcutting at an existing 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 bed of the adjacent river. This does not include scour protection for bridge approach fills.

11) Streambank protection may not impair natural stream flows into or out of secondary channels or riparian wetlands.

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

13) Fencing shall be installed as necessary to prevent access and grazing damage to revegetated sites and riparian buffer strips. If fencing is used, see activity category 9b) Construct Fencing for Grazing Control.

4.2.4 Category 2d) Install Habitat-Forming Instream Structures (Large Wood, Small Wood, and Boulders)[26]

Description

HIP provides ESA coverage for BPA funded restoration 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 have altered riparian habitats, reduced instream habitat complexity, and 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. Structures may be placed to create rearing habitat and pool formation; promote spawning gravel deposition; reduce siltation in pools; reduce the width/depth ratio of the stream; decrease flow velocities; and to connect floodplain areas for natural vegetation recruitment, habitat diversity, and high-flow refugia.

Instream structures are prone to having unintended consequences; caution must be exercised when using this approach. Structures have the potential to affect hydraulics, sediment transportation, and wood 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.

[26] 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.erdc.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

Large Wood Placements

Large wood placements are projects or structures that use trees greater than one foot in diameter at breast height, (DBH), are 15 feet or greater in length, and are used as the primary pieces within the placement or structure. These criteria do 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 include falling, pushing, hauling trees from the riparian zone, and construction of highly engineered structures such as logjams (Roni et al. 2014).

Structure design criteria should be focused on balancing biological benefit and structural resiliency. Benefits should focus on enhancing watershed driven processes including floodplain connectivity. 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. 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.

Small Wood Placements

Small wood placements are defined herein as projects or structures that use trees that are less than one foot in diameter DBH and 15 feet or less in length.

This activity includes the installation of small wood in-channel structures that improve habitat by flattening local stream gradients, increasing interactions between the stream and floodplain, increasing floodplain groundwater storage, capturing of relatively fine sediment in the channel, pool formation, hyporheic exchange, and riparian recovery. 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 (BDA), post assisted log structures (PALS), 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).

Boulder Placements

Boulders may be placed to restore habitat diversity in plane bed streams from which boulders have been removed, to alter plain bed channels that were historically dominated by wood, and to add habitat complexity in new or altered stream reaches. 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.

Guidelines for Risk

- ***Low Risk:*** N/A, see Section 2.4 Risk Determination for low risk consideration.
- ***Medium Risk:*** Habitat structures to start as medium risk. See Section 2.4 for other risk level considerations.
- ***High Risk:*** See Section 2.4 Risk Determination for high risk consideration.

Guidelines for Review

- BPA Functional review required for all risk levels.
- BPA Technical review required for medium and high risk.
- NMFS Engineering review is not required.
- Interagency review required for high risk projects.

A Monitoring and Adaptive Management Plan is required for process-based projects that require multi-year treatments. Scale and risk may also be considered.

Conservation Measures (Large Wood)

1) Large wood placements for primary purposes other than habitat restoration or enhancement are excluded from this consultation. Large wood placements incorporated with bank protection and slope stability shall adhere to activity categories 1c) Headcut and Grade Stabilization and 2c) Protect Streambank Using Bioengineering Methods.
2) 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.
3) Large wood anchoring shall not utilize cable. Pinning to boulders shall not be practiced in streams with recreational use.
4) The utilization of structural connections (biodegradable rope or pins) should be used minimally. Structural connections for large wood shall only be used if hydraulic conditions warrant use. 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 pins are used, protruding ends of rebar shall be cut flush with log or bent in order to prevent impaling fish, people, or wildlife.
6) Treated wood, copper- or zinc-plated hardware shall not be used in construction of habitat features. ASTM A615 and/or black steel hardware (or approved similar steels) shall be used.

7) Ballast (sediment, boulders, other logs) for structural stability of large wood shall only be used if hydraulic conditions warrant use. Rationale for structural ballast shall be justified and demonstrated in the Basis of Design Report and will be evaluated as a component of the HIP Technical Review.

8) Installation of large wood that requires ballast, excavation, or structural connections shall be designed by a licensed engineer unless BPA Technical Lead review member confirms project is low risk according to Section 2.4. Rationale for structural anchorage shall be justified and demonstrated in the Basis of Design Report. In addition, the Basis of Design Report shall include structural stability calculations (An appendix is acceptable).

9) 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.

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

11) If non-federal laws or ordinances require specific stability requirements, federal supremacy does not apply. Design shall include stability for 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.

12) Rock may be used for ballast but should be limited to what is needed to anchor the large wood. Use of rock shall be justified in Basis of Design Report, and stability calculations are required.

13) 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 may only be used in the dry.
    b) Select areas with soft substrate rather than rocky hard substrate; avoid bedrock, and
    c) Isolate the work area if possible to minimize acoustic disturbance.

Conservation Measures (Small Wood)

1) Small wood placements shall be conducted by hand or small machinery not to exceed 15,000 lbs. operating weight. If heavy equipment is required, project shall adhere to Large Wood conservation measures.

2) Small wood placements shall be constructed for floodplain reconnection in stream systems less than 4% stream gradient.
3) Additional potential effects of 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.
4) 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.
5) Structures 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.
6) 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 2:1 for exposed – embedded length whichever is more conservative. A minimum 1.5-foot clear space is recommended between posts.
7) 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.
8) 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.
9) 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.
10) No cabling, wire, mortar or other materials that serve to affix the structure to the bed, banks or upland is allowed.
11) Structures cannot unreasonably interfere with use of the waterway for navigation, fishing or recreation.

Conservation Measures (Boulder Placement)

1) Boulder placements for purposes other than habitat restoration or enhancement are not covered under this activity.
2) Boulder clusters should only be applied where a biologic or geomorphic need has been identified. Rationale for boulder placements shall be justified and demonstrated in the Basis of Design Report.
3) 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.

4) The cross-sectional area of boulder placements may not exceed 25% of the cross-sectional area of the low-flow channel.
5) 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.
6) Boulders will be machine-placed (no end dumping allowed) and will rely on the size of boulder, rather than anchoring, for stability.
7) 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.

4.2.5 Category 2e) Riparian and Wetland Vegetation Planting

Description

HIP provides ESA coverage for BPA funded restoration projects that include vegetation planting to restore natural plant species composition and structure to recover associated watershed processes and functions. Under this activity category, the Project Sponsors would plant native trees, shrubs, herbaceous plants, and/or grasses to help stabilize soils and restore riparian plant communities. 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 Risk

- ***Low Risk:*** Riparian vegetation planting is considered low-risk.
- ***Medium Risk:*** N/A.
- ***High Risk:*** N/A.

Guidelines for Review

- BPA Functional review required for all risk levels.
- BPA Technical review is not required.
- NMFS Engineering review is not required.
- Interagency review is not required.

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 would naturally occur in the project area and be appropriate for site specific hydrologic conditions.
3) Transplant material shall come from outside the bankfull width, and where such plants are abundant, and preferably 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 and be adapted for the hydrologic conditions.
6) Plantings shall utilize appropriate stock and be installed in a manner that maximizes access to groundwater sources to improve survival.

7) Plantings shall be installed during dormant periods with sufficient time for root development to improve survival (typically Fall/Winter).

8) Livestock shall be excluded from the planting area. If necessary, riparian exclusion fencing for grazing shall be installed in accordance with activity category 9b) Construct Fencing for Grazing Control.

4.2.6 Category 2f) Channel Reconstruction

Description

HIP provides ESA coverage for BPA funded channel reconstruction projects that 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.

Channel reconstruction consists of re-meandering, movement, or geomorphic modification (e.g. width/depth ratio) of the primary active channel. 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 and riparian functions.

Channel reconstruction 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 for stabilizing features shall mimic natural stream system materials (large wood, rock, gravel).

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.

Guidelines for Risk

- ***Low Risk:*** N/A, see Section 2.4 Risk Determination for low risk consideration.
- ***Medium Risk:*** Channel Reconstruction that restores historical alignments with minimal earthmoving.
- ***High Risk:*** Channel Reconstruction that creates or modifies channels through substantial earthmoving.

Guidelines for Review

- BPA Functional review required for all risk levels.
- BPA Technical review is required for all channel reconstruction.
- NMFS Engineering review is not required.
- Interagency review is required for high risk.

Channel Reconstruction requires a Staged Rewatering Plan (Section 3.2) and a Monitoring and Adaptive Management Plan (Adaptive Management discussed in Section 2.6).

Conservation Measures

1) Identify the conditions that lead to the degraded habitat and demonstrate that the channel reconstruction actions account for and correct those conditions to the extent possible.
2) Demonstrate that the proposed action will mimic natural conditions for gradient, width, sinuosity and other geomorphic and hydraulic parameters.
3) Demonstrate that proposed structural elements appropriately fit within the geomorphic context of the stream system.
4) Demonstrate that the project will be self-sustaining over time and that habitat benefits will be realized over a wide hydrologic range. Self-sustaining means the restored or created habitat would not require major or periodic maintenance but channel and floodplain processes will function naturally to maintain the habitat.
5) Demonstrate that the proposed action will not result in the creation of fish passage issues or post-construction stranding of juvenile or adult fish.
6) Designs that substantially fill the channel with unsorted alluvium using a valley bottom restoration approach such as "Stage Zero" must demonstrate that watershed process will contribute to self-sustainability of the project and that the appropriate level of technical analysis and risk mitigating measures have been met through project planning and design. Considering the experimental nature of this approach, it is highly recommended that the Project Sponsor coordinate early with the BPA EC Lead and BPA Technical Lead to maintain a shared understanding of the project through the development and design execution phases.
7) Sediment to be placed in-water shall be assessed for contaminants per HIP section 3.1.1.2.

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

Description

HIP provides ESA coverage for BPA funded material sediment nourishment projects in tributary and estuary environments to improve spawning and rearing habitat in reaches where natural sediment supplies are low. Sediment supply in tributaries can be limited due to a variety or combination of reasons including past channel straightening, dredging and channel hardening. In the estuary, sediment supply is limited in part due to the presence of numerous dams in the Columbia basin that trap sediments and reduce stream power in the lower river.

Sediment augmentation, particularly in conjunction with tributary restoration treatments designed to promote more temporal storage, can be effective in increasing active river processes, floodplain connectivity and channel complexity. Sediment placed along estuary and lower Columbia River shorelines can create shallow-water habitat to compensate for loss of natural sediment and concurrent diminishment of migratory habitat and food-web support.

Guidelines for Risk

- ***Low Risk:*** N/A, see Section 2.4 Risk Determination for low risk consideration.
- ***Medium Risk:*** All sediment & gravel placement.
- ***High Risk:*** N/A, see Section 2.4 Risk Determination for high risk consideration.

Guidelines for Review

- BPA Functional review required for all risk levels.
- BPA Technical review is required for medium and high risk.
- NMFS Engineering review is not required.
- Interagency review is required for high risk.

Conservation Measures (Tributary)

1) For large channel fill projects that seek to immediately change geomorphic character of the river, see activity category 2f) Channel Reconstruction.
2) Augmentation will only occur in areas where the natural supply has been eliminated, substantially 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.
3) Spawning gravel or sediment 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. Sediment must be free of invasive species and non-native seeds to the extent practicable in the existing environment.
4) Spawning gravel or sediment to be placed instream must be obtained from an upland source outside of the current active channel and riparian area unless the material was anthropogenically placed on or near the floodplain.

5) Spawning gravel or sediment shall be placed in locations with sufficient energy to mobilize the material. After placement of gravel or sediment, allow the stream to naturally sort and distribute the material.
6) Do not place gravel directly on bars and riffles that are known spawning areas, which may cause fish to spawn on the unsorted and unstable gravel, thus potentially resulting in redd destruction.
7) Sediment to be placed in-water shall be assessed for contaminants per HIP section 3.1.1.2.

Conservation Measures (Estuarine)

1) Sediment source shall be from previously dredged material. However, HIP does not cover dredging that specifically takes place to source the material.
2) 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.
3) Sediment to be placed in-water shall be assessed for contaminants per HIP section 3.1.1.2.

4.3 Category 3: Invasive Plant Control

4.3.1 Category 3a) Manage Vegetation Using Physical Control

Description

HIP provides ESA coverage for BPA funded projects that manage vegetation in fluvial and estuarine systems using two mechanism of physical control: (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 bankfull width.

Guidelines for Risk

- ***Low Risk:*** N/A, see Section 2.4 Risk Determination for low risk consideration.

Guidelines for Review

- BPA Functional review required for all risk levels.

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

HIP provides ESA coverage for BPA funded projects that manage 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.

Guidelines for Risk

- ***Low Risk:*** N/A, see Section 2.4 Risk Determination for low risk consideration.

Guidelines for Review

- BPA Functional review required for all risk levels.

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) 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.
    a) **2,4-D.** As a result of the national consultation on herbicides[27], 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.

[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

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
Fluroxypyr (upland only)	Vista ®	20 oz (upland only)

Active Ingredient	Typical Products	Maximum Label Application Rate (ai/ac)
Fluazifop-P-butyl (upland only)	Fusilade®	0.16-0.25 lb
Oryzalin (upland only)	Surflan® Fugitive®	2-4 lb
Diquat dibromide (upland only)	Alligare®	See label

4) **Adjuvants.** BPA proposes to use the adjuvants in Table 4 in the typical application rates for invasive plant control. Appropriate use of adjuvants are intended to reduce the overall amount of herbicide applied through effective control and efficiency measures.

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	Alligare
	Activator 90®
	Agri-Dex®
	Bond®
	Bronc-Max®
	Competitor®
	Class Act®
	Entry II®
	Hasten®
	LI 700®
	Liberate®
	R-11®
	Super Spread MSO®

Adjuvant Type	Trade Name
Drift Retardants	Syl-Tac®
	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

[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

Active Ingredient	Broadcast Application[28]		Backpack Sprayer/Bottle[29] Spot Spray Foliar/Basal		Hand Application[30] Wicking/ Wiping/ Injection
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 (upland only)	300	10/2	300	5/2	300
Fluazifop-P-butyl (upland only)	300	10/2	300	5/2	300
Oryzalin (upland only)	300	10/2	300	5/2	300
Diquat dibromide (upland only)	300	10/2	300	5/2	300
Herbicide Mixtures	Most conservative of listed herbicides	Most conservative of listed herbicides	Most conservative of listed herbicides	Most conservative of listed herbicides	Most conservative of listed herbicides

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	Plants	Mammals	Birds	Invertebrates
2,4 –D	Not Allowed	Not Allowed	Not Allowed	Not Allowed
Aminopyralid	0.11	0.11	0.11	Not Allowed
Chlorsulfuron (Hand Application only)	0.188	0.188	0.188	Not Allowed
Clethodim	<1.0	<1.0	<1.0	<1.0
Clopyralid	0.5	0.5	0.5	0.5
Dicamba	<1.0	<1.0	<1.0	<1.0
Glyphosate	2.0	2.0	2.0	2.0
Imazapic[31]	0.189	0.189	0.189	Not Allowed
Imazapyr	1.0	1.0	1.0	Not Allowed
Metsulfuron[32]	0.15	0.15	0.15	Not Allowed
Picloram	Not Allowed	Not Allowed	Not Allowed	Not Allowed
Sethoxydim[33]	0.3	0.3	0.3	0.3
Sulfometuron	Not Allowed	Not Allowed	Not Allowed	Not Allowed
Triclopyr (TEA)	Not Allowed	Not Allowed	Not Allowed	Not Allowed
Fluroxypyr	Not Allowed	Not Allowed	Not Allowed	Not Allowed
Fluazifop-P-butyl	0.188	0.188	0.188	0.188
Oryzalin (Hand application only)	2	2	2	2
Diquat dibromide	Not Allowed	Not Allowed	Not Allowed	Not Allowed

[31] Highly soluble in water, degrades slowly in soil, is persistent, and has a highly leaching potential which may contaminate groundwater. Cannot be use on sandy soil or sandy loamy soils and/or where distance to groundwater is <10ft.

[32] Highly soluble in water and has a highly leaching potential which may contaminate groundwater. Cannot be use on sandy soil or sandy loamy soils and/or where distance to groundwater is <10 ft.

[33] Sethoxydim is considered acutely toxic to bees (USEPA 2015). Whenever possible, but especially when the application method is "broadcast," sethoxydim should not be applied when native plants are blooming and may attract bees to the area.

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

Description

HIP provides ESA coverage for BPA funded projects that manage vegetation in estuarine systems using herbicides. Invasive plant treatments in tidally influenced areas are proposed within tidal wetlands and areas below the Ordinary High Water (OHW)[34]. 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.

Guidelines for Risk

- ***Low Risk:*** All applications of herbicides in the uplands (>300 feet) that adhere to all listed conservation measures.
- ***Medium Risk:*** All applications of herbicides in the Estuary that deviate from the criteria.
- ***High Risk:*** All applications of herbicides within low marsh in the Estuary (CR below Bonneville Dam, including tidal CR tributaries).

Guidelines for Review

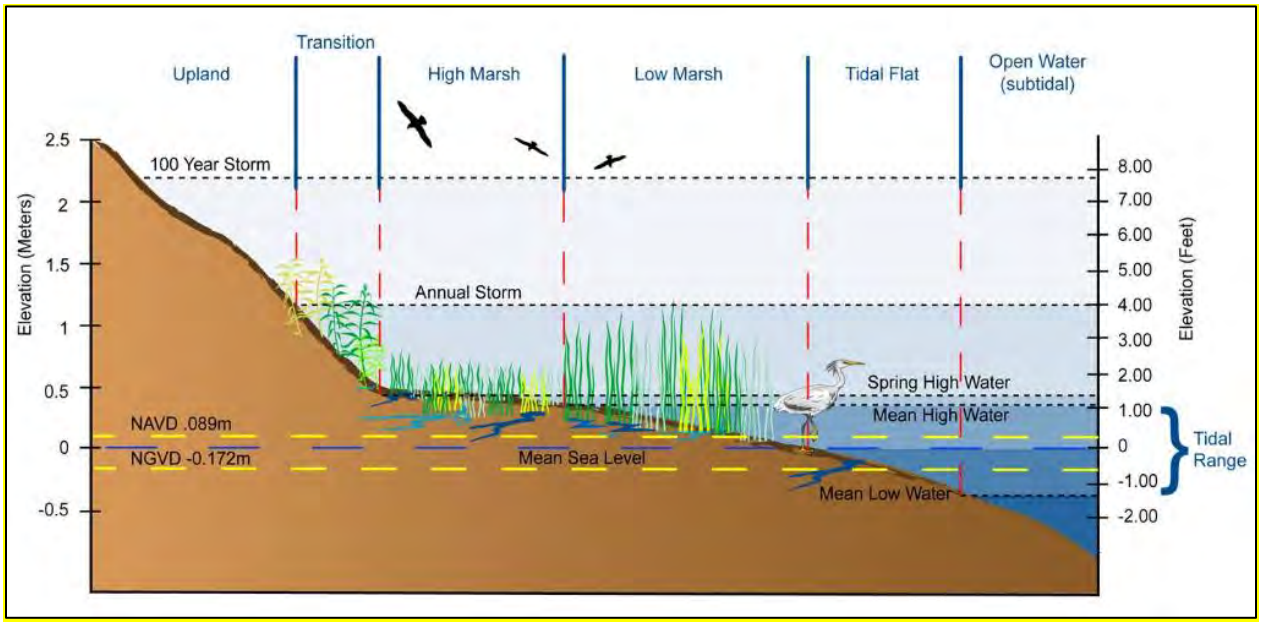
All medium to high risk Estuarine Herbicide projects shall require NMFS branch chief or workgroup approval. To facilitate this evaluation, a Herbicide Application Memo (HAM) shall be drafted that contains the following information:

1) Application methodology
2) Application Timing
3) Deviations from HIP4 conservation measures
4) Application areas in high, low marsh, tidal flats
5) Lidar and tidal/ water surface elevation inundation maps

This memo shall be evaluated to confirm if the proposal is within the range of effects described in the HIP4 Biological Opinion, if not, additional conservation measures or restrictions may be prescribed that contain the action within the programmatic, or a formal individual consultation may be pursued. After the first year of implementation and with satisfactory process implementation, and upon approval of NMFS, Herbicide Application Memos shall not be needed for subsequent years.

[34] 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.

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 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[35] or Backpack Sprayer/Bottle[36]	Broadcast Application or Backpack Sprayer/Bottle	Hand Application[37] 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.
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.

[35] Ground-based only broadcast application methods via truck/ATV with motorized low-pressure, high-volume sprayers using spray guns, broadcast nozzles, or booms.
[36] Spot and localized foliar and basal/stump applications using a hand-pump backpack sprayer or field-mixed or pre-mixed hand-operated spray bottle.
[37] 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.

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) Manage Vegetation Using Herbicides (Willamette Basin Sloughs, Side Channels, and Wetlands)

Description

HIP provides ESA coverage to fund management of emergent vegetation using chemical herbicides to recover watershed processes and functions associated with native plant communities in fluvial systems.

The control of invasive and noxious weeds through aquatic application of herbicides is proposed within existing sloughs, side channels, and wetlands located in targeted Willamette River corridor in the Willamette Basin in the following target geographic areas.

- Molalla/Pudding River Confluence to Columbia River.
- Minto Island to Yamhill River Confluence.
- Long Tom River Confluence to Santiam River Confluence.
- Middle Fork – Coast Fork Confluence to Mc Kenzie River Confluence.

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

Guidelines for Risk:

- ***Medium - High Risk:*** All aquatic applications of herbicide upon surface waters are considered medium - high risk.

Guidelines for Review:

All medium to high risk Estuarine Herbicide projects shall require NMFS branch chief or workgroup approval. To facilitate this evaluation, a Herbicide Application Memo (HAM) shall be drafted that contains the following information:

1) Application methodology
2) Application Timing
3) Deviations from HIP4 conservation measures
4) Application areas in high, low marsh, tidal flats
5) Lidar and tidal/ water surface elevation inundation maps

This memo shall be evaluated to confirm if the proposal is within the range of effects described in the HIP4 Biological Opinion, if not, additional conservation measures or restrictions may be prescribed that contain the action within the programmatic, or a formal individual consultation may be pursued. After the first year of implementation and with satisfactory process implementation, and upon approval of NMFS, HAMs shall not be needed for subsequent years.

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

3) **Herbicides**. The following conservation measures will be included as part of the proposed action to minimize and avoid adverse effects to UWR Chinook salmon and Steelhead their designated Critical Habitat elements. These measures will include the following:
   a) Conduct herbicide application and hand removal of weeds between June 1 and October 15 of each of the three years of treatment.
   b) All herbicides will be applied according to manufacturer's label.
   c) All product label "precautionary" statements such as environmental hazards, physical or chemical hazards, soil and climate application restrictions, wildlife warnings, and threatened and endangered species warnings will be followed.
   d) Herbicides will only be applied by a licensed applicator and only in accordance with U.S. Environmental Protection Agency labeling.
   e) Herbicides will not be applied when conditions stated on the herbicide label cannot be met and when air turbulence significantly affects the desired spray pattern.
   f) Applicators will never leave herbicides or equipment unattended in unrestricted access areas.

g) Applicators will keep records of each application, the active ingredient, formulation, application rate, date, time, location, etc., as required by law. Records will be available to state and federal inspectors, and will be supplied to applicable regulatory agencies and land managers as requested.
h) Herbicides will be directed only onto targeted areas.
i) Glyphosphate formulations containing polyoxyethylene tallow amine (POEA) will not be used to reduce risk to aquatic dependent species and wet area habitat.

4) **Herbicides.** BPA proposes to use the herbicides in Table 9 in the typical application rates for invasive plant control.

Table 9 Herbicides & Surfactants Proposed for Aquatic Application.

Herbicide	Application Timing	Application Rate	Target Species
Glyphosate (Herbicide)	Spring/Summer/Fall	4.0-5.0 lbs. ai/ac	Water primrose
Agri-Dex® Crop oil concentrate (Surfactant)		4 pints in 20-100 gallons of spray mixture/acre; not to exceed 0.5% volume/volume (vv) concentration	

4.3.5 Category 3e) Juniper Burning

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.

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.

4.3.7 Category 3f) Prescribed burning

Description

HIP provides ESA coverage for BPA funded projects that utilize prescribed burning. 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[38]:*** 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.

[38] Migratory Bird Treaty Act Requirement.

4.4 Category 4: Piling Removal

Description

HIP provides ESA coverage for BPA funded projects that 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

HIP provides ESA coverage for BPA funded road and trail maintenance and decommissioning activities that have an overall habitat uplift.

4.5.1 Category 5a) Road Maintenance

Description

HIP provides ESA coverage for BPA funded projects that include road maintenance activities, including creation of barriers to human access (e.g., gates, fences, boulders, logs, tank traps, vegetative buffers, and signs); surface maintenance (e.g., building and compacting the road prism, grading, and spreading rock or surfacing material); drainage maintenance and repair of inboard ditch lines, water bars, and sediment traps; and removal/stabilization of pre-existing cut and fill material or slide material.

Guidelines for Risk

- ***Low Risk:*** Barrier creation, surface maintenance, and drainage maintenance are low risk activities. Stabilization activities outside the 100-year flood flow elevation are low risk.
- ***Medium Risk:*** Stabilizing materials below the 100-year flood flow elevation shall start at the medium risk level to verify hydraulic impacts and risk.
- ***High Risk:*** N/A, see Section 2.4 Risk Determination for high risk consideration.

Guidelines for Review

- BPA Functional review required for all risk levels.
- BPA Technical review required for medium and high risk.
- NMFS Engineering review is not required.
- Interagency review required for high risk projects

Conservation Measures

1) Stabilization actions below the 100-year flood flow elevation shall be submitted for Technical Review to determine if bank stabilization conservation measures apply. See activity category 2c) Protect Banks Using Bioengineering Methods.
2) Asphalt resurfacing of permanent roads inside a riparian area is not allowed. See Section 4.1 regarding exception for bridge approaches**.**
3) Widening roads is not allowed in riparian zones.
4) Road grading and shaping will maintain the existing designed drainage of the road, unless modification is necessary to improve drainage problems that were not anticipated during the design phase.
5) Road maintenance will not be attempted when surface material is saturated with water and erosion problems could result.

6) 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.
7) Spill containment equipment will be available during chemical dust abatement application.
8) No petroleum-based products will be used for dust abatement.
9) 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).
10) 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.
11) Disturbance of existing vegetation in ditches and at stream crossings will be minimized to the greatest extent possible.
12) Ditches and culverts will be promptly cleaned of materials resulting from slides or other debris.
13) 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
14) 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.
15) Ditch back-slopes will not be undercut to avoid slope destabilization and erosion acceleration.
16) When blading and shaping roads, excess material will not be sidecast onto the fill. 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%. 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.
17) 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.

4.5.2 Category 5b) Road Decommissioning

Description

HIP provides ESA coverage for BPA funded projects that decommission (decompact, recontour, or reshape) roads that are no longer needed (e.g., old or temporary logging roads), and relocate roads in order to increase floodplain connectivity.

Guidelines for Risk

- ***Low Risk:*** Roads that do not have a raised bed or will not result in altered hydraulics after decommissioning and relocation may be considered low risk following conceptual design submittal (see Section 2.4).
- ***Medium Risk:*** Road decommissioning and road relocation shall start at the medium risk level to verify hydraulic impacts and risk.
- ***High Risk:*** N/A, see Section 2.4 Risk Determination for high risk consideration.

Guidelines for Review

- BPA Functional review required for all risk levels.
- BPA Technical review required for medium and high risk.
- NMFS Engineering review is not required.
- Interagency review required for high risk.

Conservation Measures

1) Roads that act as a berm or levee, or roads that will alter the floodplain hydraulics after removal shall meet conservation measures for activity categories 2a) Improve Secondary Channels and Floodplain Connectivity and 2b) Set-back or Removal of Existing Berms, Dikes, and Levees.
2) If passage is required at relocated bridges and culverts, see Transportation Infrastructure activities in Section 4.1, Fish Passage Restoration. Dissipaters, chutes, or rock will be placed at remaining culvert outlets where passage is not required.
3) Widening roads or new construction/relocation of any permanent road inside a riparian area is not allowed unless there is a net decrease of roads in riparian area and demonstrated habitat improvement.
4) Recontour the affected area to mimic natural floodplain contours and gradient to the extent possible. Surface drainage patterns will be recreated. Sediment catch basins will be created as necessary.
5) Waste material, asphalt, angular gravel, culverts, and bridges will be removed during decommissioning and disposed outside the 100-yr floodplain. Boulders may be reused for habitat forming structures if applicable conservation measures from 4.1 and 4.2 are met.
6) Excess materials may be reused to restore natural or near-natural contours if approved by a geotechnical engineer or other qualified personnel.
7) All bare-soil surfaces will be revegetated to reduce surface erosion.
8) 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.

4.6 Category 6: In-Channel Nutrient Enhancement

Description

HIP provides ESA coverage for BPA funded projects that include 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

HIP provides ESA coverage for BPA funded projects that convert inefficient irrigation systems (including flood irrigation) to drip or sprinkler irrigation systems. Activities may include the installation of pipes via trenching and burying, and pumps to pressurize the system.

Guidelines for Risk

- ***Low Risk***: Action may be changed to low risk following initial review and confirmation that water savings are achievable and sustainable.
- ***Medium Risk***: Initial submittal shall be considered medium risk. 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.
- ***High Risk***: N/A, see Section 2.4 Risk Determination for higher risk consideration.

Guidelines for Review

- BPA Functional review required for all risk levels.
- BPA Technical review required for medium and high risk.
- NMFS Engineering review is not required.
- Interagency review required for high risk projects.

Conservation Measures

1) Designs shall demonstrate a net instream benefit will be achieved for all flows when the diversion is in use.
2) Designs shall quantify instream savings for all periods the diversion is in use and describe how water savings will be protected from other consumptive use.
3) Designs shall identify the approximate downstream extent of the flow benefit.

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

Description

HIP provides ESA coverage for BPA funded projects that convert open ditch irrigation water conveyance systems to pipelines in order 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 Risk

- ***Low Risk***: Action may be changed to low risk following initial review and confirmation that water savings are achievable and sustainable.
- ***Medium Risk***: Initial submittal shall be considered medium risk. 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.
- ***High Risk***: N/A, see Section 2.4 Risk Determination for higher risk consideration.

Guidelines for Review

- BPA Functional review required for all risk levels.
- BPA Technical review required for medium and high risk.
- NMFS Engineering review is not required.
- Interagency review required for high risk projects.

Conservation Measures

1) Designs shall demonstrate a net instream benefit will be achieved for all flows when the diversion is in use.
2) Designs shall quantify instream savings for all periods the diversion is in use and describe how water savings will be protected from other consumptive use.
3) Designs shall identify the approximate downstream extent of the flow benefit.

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

Description

HIP provides ESA coverage for BPA funded projects that install wells 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 by following all criteria outlined in the activity category 1b) Consolidate or Replace Existing Irrigation Diversions section.

Guidelines for Risk

- ***Low Risk:*** Instream diversions converted to groundwater wells are considered low risk.
- ***Medium Risk:*** N/A.
- ***High Risk:*** N/A.

Guidelines for Review

- Functional review is required for low risk.
- No other reviews required for low risk.

Conservation Measures

1) Decommissioning of instream diversions shall meet conservation measures for activity category 1a) Dams, Water Control Structures, or Legacy Structures Removal.
2) Designs shall demonstrate and quantify habitat benefits in terms of how the proposed action will improve instream flows considering both seasonality and aquatic species presence.
3) New wells will be located more than ¼ mile from the stream.
4) New wells will not be hydrologically connected to the stream.

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

Description

HIP provides ESA coverage for BPA funded projects that install or replace cooling systems at above-ground pipes and open ditches that return tailwater from flood-irrigated fields back to the river. 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 Risk

- ***Low Risk:*** Return flow cooling systems are considered low risk.
- ***Medium Risk:*** N/A.
- ***High Risk:*** N/A.

Guidelines for Review

- Functional review is required for low risk.
- No other reviews required for low risk.

Conservation Measures

1) Designs shall demonstrate and quantify habitat benefits.
2) Disturbance to riparian vegetation shall be avoided.

4.7.5 Category 7e) Install Irrigation Water Siphons

Description

HIP provides ESA coverage for BPA funded projects that install siphons transporting irrigation water beneath waterways, where irrigation ditch water currently enters a stream and commingles with stream water and is subsequently withdrawn on the opposite side of the stream. Periodic maintenance of the siphon will be conducted.

Guidelines for Risk

- ***Low Risk:*** Siphon construction that does not require instream work or dewatering.
- ***Medium Risk:*** Siphons that require in-channel work.
- ***High Risk:*** N/A, see Section 2.4 Risk Determination for higher risk considerations.

Guidelines for Review

- Functional review required for all risk levels.
- Technical review required for medium risk levels.
- NMFS Engineering review not required.
- Interagency reviews required if high risk.

Staged Rewatering Plan (Section 3.2) required for construction flow diversions.

Conservation Measures

1) Decommissioning of instream structures shall meet conservation measures for activity category 1a) Dams, Water Control Structures, or Legacy Structures Removal.
2) Directional drilling to create siphon pathway will be employed whenever possible.
3) Trenching will occur in dry stream beds only.
4) No part of the siphon structure will block fish passage.
5) Siphon surface structures will be placed outside 1.5 times bankfull width (see Section 4.1 for bankfull width calculation), or set back a minimum of 10 feet from the bankfull delineation, whichever is greater.
6) Minimum cover over a siphon structure within the streambed shall be 2x design flow scour depth or 3 feet, whichever is greater.
7) Waterways will be reconstructed to a natural streambed configuration using stream simulation material upon completion.
8) Stream widths will be maintained at bankfull width or greater.
9) 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

HIP provides ESA coverage for BPA funded projects that install livestock watering facilities. 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. Placement of the pipes in the ground will typically involve minor trenching using a backhoe or similar equipment.

Guidelines for Risk

- ***Low Risk:*** New construction activities with no in-water work.
- ***Medium Risk:*** New construction activities that require in-water work.
- ***High Risk:*** N/A.

Guidelines for Review

- Functional review is required for all risk levels.
- Technical review required for medium and high risk levels.
- NMFS Engineering review required for diversions greater than or equal to 3cfs.
- Interagency reviews not required for low and medium risk.

Conservation measures

1) Diversions converted to groundwater well shall meet conservation measures for activity category 7c) Convert from Instream Diversion to Groundwater Wells.
2) Designs shall demonstrate habitat benefit (instream water savings and/or reduction of livestock in stream).
3) 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).
4) 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.
5) Pipes should be less than 4 inches. If larger pipes are required, designs shall justify need for required size.
6) The location shall avoid steep slopes.
7) Each livestock water development shall have a float valve or similar device limiting use to demand and include a return flow system.
8) The livestock water development shall include a fenced overflow area or similar means to minimize potential runoff and erosion.

4.7.7 Category 7g) Install, Upgrade, or Maintain Fish Exclusion Devices and Bypass Systems

Description

HIP provides ESA coverage for BPA funded projects that install, upgrade or maintain fish exclusion devices and bypass systems. This category does not cover screen installations for new water diversions. 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. Actions covered by this activity category cover fish exclusion and do not include in-stream diversion structures (see Section 4.1 fish passage activities).

Guidelines for Risk

- ***Low Risk:*** Actions that can completed by hand, in the dry, or downstream of a closed headgate are considered low risk. Low risk actions may occur outside the in-water work window.
- ***Medium Risk:*** In-water work upstream of any headgate or downstream of an open headgate that is unable to be performed by hand is considered medium risk.
- ***High Risk:*** N/A, see Section 2.4 Risk Determination for higher risk consideration.

Guidelines for Review

- Functional review is required for all risk levels.
- Technical review required for medium and high risk levels.
- NMFS Engineering review and approval is required medium and high risk actions with diverted flow by gravity or pumping at a rate greater than or equal to 3 cubic feet per second.
- Interagency reviews required for high risk actions.

Guidelines for PNF and PCF

Project Sponsors 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). Medium and high risk actions shall have individual PNFs and PCFs.

Conservation Measures

1) Construction and modifications to the in-stream diversion structure or other in-water structures upstream of the headgate shall meet conservation measures of the appropriate activity category in Section 4.1, most likely category 1b) Consolidate or Replace Existing Irrigation Diversion.
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) In-water maintenance upstream of screens shall provide fish exclusion or fish passage benefits.
4) 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).
5) Diversion water intake and return points will be installed, replaced, upgraded, or removed, to prevent salmonids of all life stages from swimming into, or being entrained within, the diversion system.
6) All large wood and sediment recovered during cleaning and maintenance may be placed downstream of the diversion.

4.8 Category 8: Fisheries, Hydrologic, and Geomorphologic Surveys

Description

HIP provides ESA coverage for BPA funded projects that include 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

HIP provides ESA coverage for BPA funded projects that include 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) Fencing Construction for Grazing Control

Description

HIP provides ESA coverage for BPA funded projects that construct permanent or temporary livestock exclusion fences or cross-fences 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 bankfull width.

4.9.3 Category 9c) Plant Vegetation

Description

HIP provides ESA coverage for BPA funded projects that plant trees, shrubs, vines, grasses, and legumes 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

HIP provides ESA coverage for BPA funded projects that remove trees for large wood projects. 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.

4.9.5 Category 9e) Willamette Valley Prairie Restoration

BPA shall provide funding for land purchases to fulfill commitments made by BPA in the 2010 "Willamette River Basin Memorandum of Agreement Regarding Wildlife Habitat Protection and Enhancement between the State of Oregon and the Bonneville Power Administration." This is part of ongoing efforts to mitigate for the impacts to fish and wildlife from the construction and operation of federal flood control and hydroelectric facilities in the Willamette River Basin.

In addition, BPA provides funding for operations and maintenance for a growing network of conservation lands in the Willamette Valley providing important and long lasting fish and wildlife habitat benefits. Conserving habitat on the property also partially fulfills BPA's habitat restoration and protection responsibilities under the Willamette Project Biological Opinions (NMFS 2008, USFWS 2008).]"

The Willamette Valley has several listed species that may exist on these lands and be affected by the restoration, operations and maintenance of these lands. These species include:

- 5 plant species (Bradshaw's lomatium, golden paintbrush, Kincaid's lupine, Nelson's checker-mallow, and Willamette daisy)
- Streaked horned lark.

NOTE: Due to complete species absence BPA has made a No Effect Determination for anadromous ESA-listed salmonids for the following actions

These proposed restoration actions, including maintenance shall be conducted in upland areas (>300 feet from bankfull width), oak savannah and prairie habitats, and forest habitats in the Willamette Valley. Proposed aquatic actions, as described in the main body of the BA, may also occur in the Willamette Valley; however, in those instances in the Willamette Valley where listed plant, butterfly and bird species are present, the appropriate Willamette Valley conservation measures, as described in this section, will be incorporated into the project design and implementation. Categories of restoration and management activities described in this category include:

1) Surveys
2) General Conservation Measures
3) Manual and Mechanical Methods
4) Livestock Grazing
5) Prescribed burning,

The following proposed restoration actions and conservation measures are specific to the Willamette Valley and necessary to minimize impacts to the listed species named above. Thus, in circumstances where actions occur and any of the seven Willamette Valley species are present, the following restoration actions and conservation measures must be followed to ensure ESA coverage under the proposed HIP4 programmatic ESA consultation.

Surveys

Within the Willamette Valley, if a known site of an ESA-listed plant is within 0.4 km (0.25 mi) of the project action area, or suitable or potential habitat may be affected by project activities, then a BPA contract botanist will conduct a site visit/vegetation survey to determine whether ESA-listed plants are within the project area. This visit and survey will be conducted at the appropriate time of year to identify the species and determine whether individual listed plants or potential habitat are present and may be adversely affected by project activities (Table 10).

Table 10: Optimal Survey Times for Flowering Periods of Listed Plants in OR and WA.

Species	Optimal Survey Time Period*
Bradshaw's lomatium (*Lomatium bradshawii*)	April to mid-May
Golden paintbrush (*Castilleja levisecta*)	April to September
Kincaid's lupine (*Lupinus sulphureus* ssp. *kincaidii*)	May through July
Nelson's checkermallow (*Sidalcea nelsoniana*)	Late May to Mid-July
Willamette daisy (*Erigeron decumbens* var. *decumbens*)	Mid-June to early July

For aquatic restoration projects where listed plants are present:

Where Willamette Valley listed plant(s) are present at the site and habitat conditions may or may not be improved for listed plants:

> Establish clearly marked buffers to avoid effects to listed plants and identify treatment areas with flagging or fencing prior to restoration activities to minimize effects to listed plants.
> If the site and location of listed plants is such that goals of the aquatic restoration project cannot be achieved without harming or killing a portion or all listed plant(s) at the site, the project manager will work with the appropriate local Service office to develop a site plan that minimizes the number of plants that are harmed or killed while still achieving project goals and objectives. The plan will include which plants will be affected, including salvage and relocation of these plants if deemed appropriate.

Willamette Valley General Conservation Measures

1) A qualified biologist with experience in pertinent species will determine whether there are listed plants, larks, critical habitat, or suitable habitat in the project area. If the site conditions warrant, surveys and site visits will be conducted at the appropriate time of year to identify all listed plant species and determine whether individual listed plants or potential habitat are present and may be adversely affected by project activities. (See Table 12 for survey timing).

2) If one or more listed plants or larks are present and likely to be adversely affected by the project, the project will establish clearly marked buffers to avoid or minimize effects to listed plants. Buffers from listed plants are as follows:

   a) Vehicle and equipment staging areas will be located at least 15 m (50 feet) from listed plants.

   b) Manual and mechanical methods to remove invasive/non-native plants at project sites occupied by a listed plant species will maintain a buffer of 2 m (6 feet) around green growing plants. If listed plants have senesced, this buffer is no longer required.

   c) Tilling, disking, plowing, excavation, raking or sod rolling (*i.e.,* larger scale sub-surface ground disturbances) or other use of heavy equipment will not occur within 10 m (33 feet) of listed plants.

   d) Spot and hand applications of herbicide will maintain a minimum distance of 1 m (3.3 feet) from listed plants, unless they are dormant, in which case no buffer is required.

   e) Broadcast applications will maintain a minimum distance of 3 m (16 feet) from listed plants.

   f) For all herbicide applications, listed plants will be physically shielded (e.g., covered with buckets or some other barrier that will not harm the plants) as needed to protect them from spray or drift, unless they are dormant, in which case shielding is not necessary. Plants will be uncovered immediately after spraying has been completed.

3) Dust-abatement additives and stabilization chemicals will not be applied within 10 m (33 feet) of listed plants or critical habitat for listed plants.

4) Prior to restoration activities at areas with listed plants, all project staff will be familiarized with identification of any listed plants in the area and will be aware of listed plant locations within the project area.

5) Access points and tracks within occupied, suitable or critical habitats for listed plant species must be limited and clearly marked to avoid soil compaction and damage to listed plant species from vehicles and/or foot traffic.

6) Herbicides will not be applied at locations where nearby listed plants may be in the path of surface runoff from the project.

7) Ground-disturbance activities (*e.g.,* tilling, disking, and plowing) and herbicide use should be followed with native seed or plant introductions to minimize or eliminate the establishment of invasive and non-native vegetation, unless it is determined the local seed source/bank is sufficient.

Willamette Valley Manual and Physical Controls

1) Limit native vegetation removal and soil disturbance within the riparian zone by limiting the number of workers to the minimum necessary to complete manual, mechanical, or hydro-mechanical plant control (e.g., hand pulling, bending[39], clipping, stabbing, digging, brush-cutting, mulching, radiant heat, portable flame burner, super-heated steam, pressurized hot water, or hot foam).

2) Do not allow cut, mowed, or pulled vegetation to enter waterways.

3) Mowing. Sites may be mowed using tractor mowers, flail mowers, or hand-held mowers (e.g. rotary line trimmers). In sites supporting populations of listed plants and/or butterflies:

    a) Mowing will generally be implemented in the fall and winter, after listed plants have senesced for the season and /or butterflies are in diapause (Table 13).

    b) Tractor mowers should be rubber-tracked to minimize soil compaction and/or rutting.

    c) Tractor mowing decks should be set sufficiently high to avoid soil gouging; see Table 13 for species specific information.

    d) Mowing activities will follow the timing restrictions and mower height settings provided in Table 13 for all affected listed species.

    e) Spring mowing is allowed at restoration sites with listed plant species, as indicated in Table 13, but only if necessary to control serious infestations of weeds that reproduce mainly by seed (e.g., meadow knapweed) and threaten persistence of the listed species in that area. In these instances, up to one half of area occupied by the listed plant population(s) at a site may be mowed in an effort to reduce seed set by non-native weeds. Spring mowing must be approved by the local Service office and species lead.

4) Manual removal. Invasive plants may be removed year-round using manual methods and hand tools, including hoeing, grubbing, pulling, clipping or digging. Tools that may be used include shovel, hoe, weed wrench, lopping shears, trowel, etc.

5) Cutting/thinning/removing tree stumps. Handheld power tools may be used to cut down woody vegetation, control and remove invasive woody plants, and reduce tree density. The extent of these actions could be guided by reviews of site records (including aerial photographs) and percent cover thresholds for the habitat types.

6) In highly degraded sites, low impact vehicle-mounted tree shears may be used to thin woody vegetation.

7) Tree stumps and their root systems may be removed manually or mechanically using vehicle-supported machinery to avoid re-sprouting. This should be restricted to the dry season if listed species are present.

[39] Knotweed treatment pre-treatment; See Nickelson (2013).

8) Cutting or thinning may be implemented either at times of the year when listed species are dormant, or in the case of selective manual methods where workers enter the site on foot, in such a way as to avoid trampling of any listed species.

9) If herbicides will be used to treat freshly-cut stumps, trees must be felled at times that coincide with timing restrictions for chemical use.

10) All cut material will be piled or chipped and spread away from populations of listed plants or butterflies or hauled off-site for disposal, unless material is needed to use for a prescribed burn treatment. In cases where work is done during the wet season, cut debris may be temporarily piled on-site, but away from listed plants and butterflies, until the dry season when equipment can access the work area to remove debris.

11) Girdling trees. Girdling trees involves removal of a ring of bark near the base of a tree with an axe or chainsaw. It eventually kills the tree and is done to control and remove invasive woody plants. Girdling may be applied at any time of year. Workers will enter sites on foot and take care to avoid trampling listed plants and animals, and native species that support listed animals. Depending on management objectives, girdled trees may remain on site or be removed during the dry season when listed plants and butterfly host lupines are dormant.

12) Raking. Raking is used to reduce thatch build up. Rakes may be tractor-mounted or hand-held.

13) Raking will occur when listed plants are dormant (generally August 15 to February 28).

14) Efforts will be made to avoid disturbing underlying soil.

15) In sites with listed plant species that do not senesce in the winter (e.g., Nelson's checkermallow), efforts will be made to avoid individuals of the listed plant.

16) When rakes are tractor-mounted, tractors shall be equipped with rubber tracks to minimize soil compaction.

17) Shade cloth. Used to control monotypic weed infestations. Dark cloth placed over weeds and fastened to ground with stakes for two years. Shade cloth is installed during the growing season, but will not be used directly over any individuals of listed plant or animal species but can be used 20 m (65 feet) from listed species, unless species-specific measures state otherwise.

18) Sod Rolling. Used to control invasive plants, especially those which spread by rhizomes. A bulldozer is used to roll away the top layer of soil and plant material, leaving a relatively intact soil layer beneath. The removed vegetative mats are deposited into windrows at the edge of the site, where they compost in place. This technique will not be used where listed species are present, but can be used 10 m (33 feet) from listed plant and animal species unless species-specific measures state otherwise.

19) Solarization. Also used to kill monotypic weed patches. A site is covered with plastic sheeting, which remains for at least three months during the growing season. Follow-up weeding may be necessary once plastic is removed. This technique will not be used where listed plants or animals are present, but can be used in adjacent habitat no closer than 10 m (30 feet) to listed plant and animal species unless species specific measures state otherwise.

20) Tilling/disking. A tractor with a tiller/disk attachment will be used to turn up the soil to a depth of no more than 30 cm (12 inches). This technique will be implemented along existing ground contours when possible, and will not occur during the wet season. Tilling/disking must be followed immediately with introduction of native plant species unless further weed eradication is scheduled to take place. Tilling and disking will not be used within 10 m (30 feet) of known populations of listed plant and animal species, unless species specific measures state otherwise.

Willamette Valley Livestock Grazing

1) Livestock grazing will not be used to control or remove invasive and non-native vegetation at project sites occupied by Nelson's checkermallow, unless approved by the local Service office or species lead.

2) Grazing at low-moderate levels during the dry season will be allowed in prairies after August 1 and before listed plant species emerge the following year.

3) Grazing will not occur during the wet season when soils are soft or saturated, unless approved by the local Service office and species lead.

4) Grazing intensity and duration must not result in excessive trampling of vegetation or the creation of bare soil.

5) Grazing activities will be monitored on a daily or weekly basis, as appropriate to avoid negative impacts.

6) Grazing activities will be terminated once management objectives are achieved at the project site. Animals will be removed from the site within three days of this termination.

7) Animals used in grazing activities will be isolated from invasive and non-native vegetation prior to being released into a project site to avoid contaminating the area with seeds and/or other reproductive parts from invasive and non-native vegetation.

Willamette Valley Prescribed Fire

1) Human movement in the prescribed burn area will be managed to minimize impacts on listed species and the native prairie community (except as needed for human safety).

2) Timing of burns when listed species are present will be consistent with Table 11.

3) At sites supporting listed plant species that do not completely senesce by late summer (e.g., Nelson's checker-mallow), no more than one half of the occupied habitat may be burned in any year, if burning is allowed (See Table 13).

4) Burns should be of low intensity, and take place on cool, cloudy days later in the dry season. Woody vegetation may be removed from treatment area prior to burning.

Table 11: Species-specific timing for mowing and prescribed burn methods in Willamette Valley.

Listed Plant Species	Treatment Method and Timing		
	Prescribed Burns (Calendar Timing)	**Mechanical Mowing – Timing [Mower Deck Height]**	**Spring Mowing Allowed?**
Bradshaw's lomatium	Fall burns after August 15	Fall mowing after August 15 [15 cm (6 inches)]	Yes With restrictions.
Golden Paintbrush	Fall burns after August 15	Late winter (February to March 15) mowing OK, then mow again after September 15, if site not burned	Yes- with restrictions. Complete by mid-March
Kincaid's lupine	Fall burns after August 15	Fall mowing after August 15 15 cm [6 inches)]	Yes- with restrictions.
Nelson's checkermallow	Fall burns after August 15; up to 50% of the occupied area at a site.	Fall mowing after August 15 [15 cm (6 inches)]	Yes With restrictions.
Willamette daisy	Fall burns after August 15	Fall mowing after August 15 [15 cm (6 inches)]	Yes- with restrictions.

Bonneville
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