Floodplain Mitigation Assessment

Regional Guidance for Oregon

Draft Update 2024

FEMA Region 10

Regional Guidance
For
Floodplain Mitigation Assessments in Oregon

Produced by FEMA - Region 10
Draft Update November 2024
Version 1

FEMA
Region 10

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Acknowledgements

This guidance document was developed by Region 10 of the Federal Emergency Management Agency, as part of its continuing effort to improve floodplain management practices and assist communities in meeting the requirements of the Endangered Species Act.

An earlier version of this document that was written solely for Puget Sound was drafted in 2010 by French & Associates, Ltd., Steilacoom, ESA Adolfson, Seattle, and PBS&J, Seattle, through an arrangement with the Insurance Services Office and the Community Rating System. Extensive edits were completed by FEMA Region 10 in 2013 in a document that was written solely for Puget Sound. The 2018 Update was prepared by CDM Smith and FEMA Region 10.

The 2024 Habitat Assessment Update was prepared by FEMA Region 10 to address the interim measures for implementing the Oregon Biological Opinion.

The Mitigation Assessment is a simplified version of the *Floodplain Habitat Assessment and Mitigation: Regional guidance for Oregon* intended to help communities reach No Net Loss of three floodplain functions and thereby reaching ESA compliance. The assessment identifies the 16 ESA-listed fish species of concern and the Southern resident killer whale as identified by the National Marine Fisheries Service (NMFS) and outlines the mitigation requirements to achieve No Net Loss that meets ESA compliance of said species under the Pre-Implementation Compliance Measures (PICM).

Acronyms

BA	Biological Assessment
BE	Biological Evaluation
BFE	Base Flood Elevation
BiOp	Biological Opinion
CMZ	Channel Migration Zone
CWA	Clean Water Act
Dbh	Diameter Breast Height
DLCD	Oregon Department of Land Conservation
EFH	Essential Fish Habitat
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
JPA	Joint Permit Application
MA	Mitigation Assessment
MHHW	Mean Higher-High Waterline
NFIP	National Flood Insurance Program
NMFS	National Marine Fisheries Service
NNL	No Net Loss
ODEQ	Oregon Department of Environmental Quality
ODSL	Oregon Department of State Lands
OHWM	Ordinary High-Water Mark
PICM	Pre-implementation Compliance Measures
RBZ	Riparian buffer zone
RPA	Reasonable and Prudent Alternative
SFHA	Special Flood Hazard Area
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Service

1.0 Introduction

1.1 Background

This Regional Guidance is written to assist communities in meeting the requirements and criteria of the Endangered Species Act (ESA) regarding the National Flood Insurance Program (NFIP). Those requirements are described in Biological Opinions (BiOp) issued by the National Marine Fisheries Service (NMFS) on April 14, 2016, and the January 2017 errata document that supplements the BiOp for most of the State of Oregon.

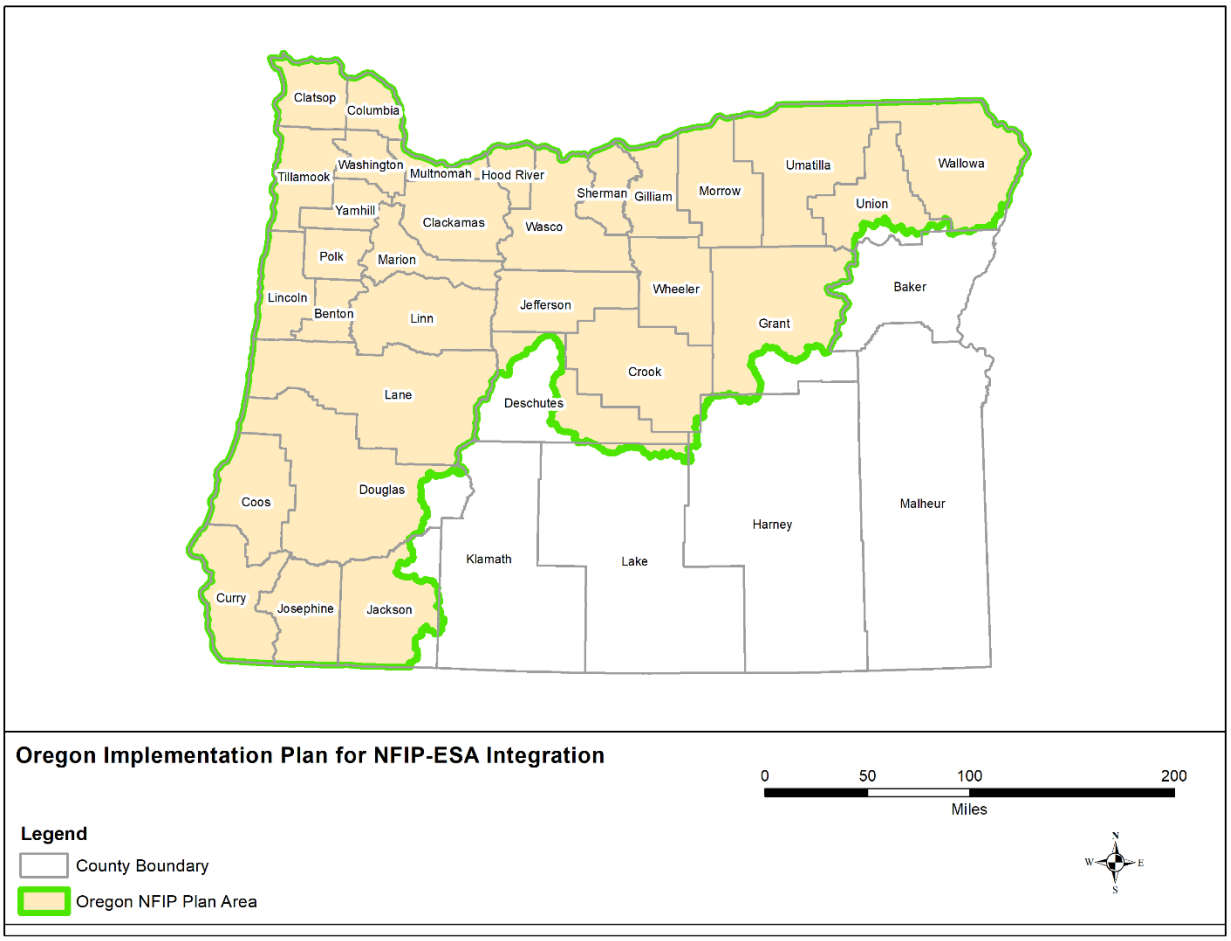


Figure 1 Oregon National Flood Insurance Program Plan Area for Endangered Species Act Integration

This guide is a companion to the BiOp for Oregon and the ESA Consultation Handbook (NMFS and USFWS 1998). It is intended to assist anyone who may potentially write or review mitigation assessments (MAs) to demonstrate ESA compliance with Pre-Implementation Compliance Measures (PICM) requirements. This document focuses on requirements specific to Oregon. It provides information on methods that communities may utilize to assess the impacts of development actions on ESA-listed species and their designated critical habitats within the Special Flood Hazard Area (SFHA).

This document is also designed to support the NFIP-ESA 2024 Draft Model Ordinance prepared by the Federal Emergency Management Agency (FEMA) Region 10. This guidance is offered to help communities comply with the interim measures specified in the Reasonable and Prudent Alternative (RPA) element 2 of the BiOp while FEMA works towards full implementation of NFIP-ESA integration efforts.

For further details on the BiOp's requirements, see the BiOp and RPA for Oregon. The Model Ordinance and additional guidance documents are also available from FEMA Region 10.

Communities in Oregon have three options to implement the interim measures of the BiOp: prohibiting all development activities within the SFHA, adopting the Model Ordinance to codify no net loss (NNL) standards, or using a permit-by-permit approach to analyze effects of development activities and implement mitigation that would achieve no net loss. Sections of the Model Ordinance are referenced in this guidance to help the reader match the requirements of the BiOp with NFIP regulations. Additional references included in this guidebook are listed at the end of the document.

ESA compliance measures require No Net Loss (NNL) of three floodplain functions essential to the survival of ESA-listed species under the jurisdiction of NMFS within the implementation area, the establishment of riparian buffer zones (RBZ) measured from the Ordinary High-Water Mark (OHWM) of a fresh waterbody and the Mean Higher-High Waterline (MHHW) from a tidally-influenced waterbody, and a beneficial gain requirement for development that is located within the RBZ.

This revised 2024 mitigation assessment guidance will help jurisdictions assess, document, and review these ESA compliance measures. It is intended to be useful to those jurisdictions who are complying with the requirements of the interim elements of the RPA in Oregon under PICM.

The objective for NFIP-ESA compliance is to ensure no net loss to ESA-listed species and their designated critical habitats by protecting those species and the natural functions of their designated critical habitats. No net loss is defined as "any development action resulting in negative impacts to one or more key floodplain functions that are then mitigated or avoided to offset said impacts." In other words, all development actions within the SFHA must be adequately avoided or mitigated to ensure that floodplain functions can operate at the same capacity as before the development action occurred. No net loss is primarily achieved through mitigation, but practicing avoidance and minimization can lessen the impact of development and the amount of mitigation required to achieve compliance. No net loss applies to the three floodplain functions of floodplain storage, water quality, and vegetation. To make calculating the values of floodplain functions easier, FEMA has translated these functions into three specific actions that can quantify the value of the functions. These actions are commonly referred to as our proxies and can be found in the table below:

Table 1: Floodplain Functions and Proxies

Floodplain Function	Proxy (No net loss of…)	Mitigates Against
Floodplain storage	Undeveloped space	Developed space
Water quality	Pervious surfaces	Impervious surface
Vegetation	Trees	Trees removed

The addition of developed space within the SFHA creates an adverse effect to the floodplain function of floodplain storage and requires the creation of undeveloped space to achieve no net loss. Likewise, the addition of impervious surfaces and the removal of trees also create an adverse effect to the floodplain functions of water quality and vegetation, respectively. To achieve no net loss for these two functions, the addition of pervious surfaces and trees are required. Mitigation to achieve no net loss must be implemented for each floodplain function that is adversely effected by development and its impacts.

At its core, a successful mitigation assessment must do the following:

1. Describe the existing site conditions where the proposed development and impacts are expected to occur.
2. Describe the project and its impacts to the floodplain functions within the SFHA.
3. Identify the mitigation required to achieve no net loss.

The preparation of this guidance was informed by technical input from local officials, engineers, natural resource scientists, and planners. It is designed to assist qualified habitat professionals, representing both permit applicants and permit officials, in ensuring that any adverse impacts from actions occurring anywhere within the Special Flood Hazard Area will be mitigated to a no net loss standard. This guidance is focused on ESA-listed species utilizing habitats in flood-prone areas, including those areas associated with streams, lakes, and marine waters.

The 2016 BiOp and 2017 errata for the NFIP in Oregon apply to 16 ESA-listed fish species and the Southern Resident killer whale. The 16 ESA-listed fish species and the southern resident killer whale are identified below:

- Lower Columbia River Chinook salmon
- Upper Willamette River spring-run Chinook salmon
- Upper Columbia River spring-run Chinook salmon
- Snake River spring/summer-run Chinook salmon
- Snake River fall-run Chinook salmon
- Columbia River chum salmon
- Lower Columbia River coho salmon

- Oregon Coast coho salmon
- Southern Oregon/Northern California Coasts coho salmon
- Snake River sockeye salmon
- Lower Columbia River steelhead
- Upper Willamette River steelhead
- Middle Columbia River steelhead
- Upper Columbia River steelhead
- Snake River Basin steelhead
- Southern eulachon
- Southern resident killer whale

1.2 Definitions

The following terms are used throughout this guidance and discussed in the Model Ordinance (Section 2.0):

Ancillary Features: Features of a development that are not directly related to the primary purpose of the development.

Base flood elevation (BFE): The elevation to which floodwater is anticipated to rise during the base flood.

Development: Any man-made change to improved or unimproved real estate, including but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations or storage of equipment or materials.

Fill: Placement of any materials such as soil, gravel, crushed stone, or other materials that change the elevation of the floodplain. The placement of fill is considered "development."

Fish Accessible Space: The volumetric space available to an adult or juvenile individual of the identified 16 ESA-listed fish to access.

Fish Egress-able Space: The volumetric space available to an adult or juvenile individual of the identified 16 ESA-listed fish to exit or leave from.

Floodplain Storage Capacity: The volume of floodwater that an area of floodplain can hold during the 1-percent annual chance flood.

Footprint: The existing measurements of the structure related to the three floodplain functions and their proxies. The footprint related to floodplain storage refers to the volumetric amount of developed space measured from the existing ground level to the BFE, and the footprint related to water quality refers to the area of impervious surface that the structure creates.

Functionally Dependent Use: A use which cannot perform its intended purpose unless it is located or carried out in proximity to water. The term includes only docking facilities, port facilities that are necessary for the loading and unloading of cargo or passengers, and ship building and ship repair facilities, but does not include long-term storage or related manufacturing facilities.

Green Infrastructure: Use of natural or human-made hydrologic features to manage water and provide environmental and community benefits. Green infrastructure uses management approaches and technologies that use, enhance, and/or mimic the natural hydrologic cycle processes of infiltration, evapotranspiration, and reuse. At a large scale, it is an interconnected network of green space that conserves natural systems and provides assorted benefits to human populations. At a local scale, it manages stormwater by infiltrating it into the ground where it is generated using vegetation or porous surfaces, or by capturing it for later reuse. Green infrastructure practices can be used to achieve no net loss of pervious surface by creating infiltration of stormwater in an amount equal to or greater than the infiltration lost by the placement of new impervious surface.

Habitat Restoration Activities: Activities with the sole purpose of restoring habitats that have only temporary impacts and long-term benefits to habitat. Such projects cannot include ancillary structures such as a storage shed for maintenance equipment, must demonstrate that no rise in the BFE would occur as a result of the project and obtain a CLOMR and LOMR, and have obtained any other required permits (e.g., CWA Section 404 permit).

Hazard Trees: Standing dead, dying, or diseased trees or ones with a structural defect that makes it likely to fail in whole or in part and that present a potential hazard to a structure or as defined by the community.

Hydrologically Connected: The interconnection of groundwater and surface water such that they constitute one water supply and use of either results in an impact to both.

Impervious Surface: A surface that cannot be penetrated by water and thereby prevents infiltration and increases the amount and rate of surface water runoff, leading to erosion of stream banks, degradation of habitat, and increased sediment loads in streams. Such surfaces can accumulate large amounts of pollutants that are then "flushed" into local water bodies during storms and can also interfere with recharge of groundwater and the base flows to water bodies.

Low Impact Development: An approach to land development (or redevelopment) that works with nature to manage stormwater as close to its source as possible. It employs principles such as preserving and recreating natural landscape features and minimizing effective imperviousness to create functional and appealing site drainage that treats stormwater as a resource rather than a waste product. Low Impact Development refers to designing and implementing practices that can be employed at the site level to control stormwater and help replicate the predevelopment hydrology of the site. Low impact development helps achieve no net loss of pervious surface by infiltrating stormwater in an amount equal to or greater than the infiltration lost by the placement of new impervious surface. LID is a subset of green infrastructure.

Mean Higher-High Water: The average of the higher-high water height of each tidal day

observed over the National Tidal Datum Epoch.

No Net Loss: A standard where adverse impacts must be avoided or offset through adherence to certain requirements so that there is no net change in the function from the existing condition when a development application is submitted to the state, tribal, or local jurisdiction. The floodplain functions of floodplain storage, water quality, and vegetation must be maintained.

Offsite: Mitigation occurring outside of the project area.

Onsite: Mitigation occurring within the project area.

Ordinary High Water Mark: The line on the shore established by the fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank; shelving; changes in the character of soil; destruction of terrestrial vegetation; the presence of litter and debris; or other appropriate means that consider the characteristics of the surrounding areas.

Pervious Surface: Surfaces that allow rain and snowmelt to seep into the soil and gravel below. Pervious surface may also be referred to as permeable surface.

Qualified Professional: Appropriate subject matter expert that is defined by the community.

Reach: A section of a stream or river along which similar hydrologic conditions exist, such as discharge, depth, area, and slope. It can also be the length of a stream or river (with varying conditions) between major tributaries or two stream gages, or a length of river for which the characteristics are well described by readings at a single stream gage.

Riparian: Of, adjacent to, or living on, the bank of a river, lake, pond, or other water body.

Riparian Buffer Zone (RBZ): The outer boundary of the riparian buffer zone is measured from the ordinary high water line of a fresh waterbody (lake; pond; ephemeral, intermittent, or perennial stream) or mean higher-high water line of a marine shoreline or tidally influenced river reach to 170 feet horizontally on each side of the stream or 170 feet inland from the MHHW. The riparian buffer zone includes the area between these outer boundaries on each side of the stream, including the stream channel. Where the RBZ is larger than the special flood hazard area, the no net loss standards shall only apply to the area within the special flood hazard area.

Riparian Buffer Zone Fringe: The area outside of the RBZ and floodway but still within the SFHA.

Silviculture: The art and science of controlling the establishment, growth, composition, health, and quality of forests and woodlands.

Special Flood Hazard Area: The land in the floodplain within a community subject to a 1 percent or greater chance of flooding in any given year. It is shown on the Flood Insurance Rate Map (FIRM) as Zone A, AO, AH, A1-30, AE, A99, AR (V, V1-30, VE). "Special flood hazard area" is synonymous in meaning and definition with the phrase "area of special flood hazard."

Undeveloped Space: The volume of flood capacity and fish-accessible/egress-able habitat from the existing ground to the Base Flood Elevation that has not been reduced due to activity that meets FEMA's definition of development. Examples of development that impede undeveloped space includes, but is not limited to, the addition of fill, structures, concrete structures (vaults or

tanks), pilings, levees and dikes, or any other development that reduces flood storage volume and fish accessible/egress-able habitat.

1.3 When to Conduct a Mitigation Assessment

Whenever a development project is proposed in the SFHA under the Permit-by-Permit approach of PICM, the property owner must obtain a floodplain development permit from the community. Unless a community's floodplain management ordinance lists a project action type as exempt from the requirement to complete a mitigation assessment (MA) (see Section 1.3.1), the project applicant must complete a MA that identifies existing site conditions before development occurs, describes the impact of the proposed development on existing floodplain and instream habitat functions, and identifies mitigation required to achieve no net loss. The scope and detail of that assessment may vary as needed to portray possible impacts for each project. If the anticipated project effects are clearly limited in nature and extent, it may be possible to describe them in a relatively short assessment. The greater the complexity, scope, and/or risk of possible impacts to ESA-listed species or their habitats, the more likely it will be that the HA will need to be an in-depth analysis to portray impacts and describe planned mitigation if needed.

1.3.1 No Mitigation Assessment Required

Under the Permit-by-Permit PICM approach, there are three general circumstances where a MA and no net loss standards would not be required:

1. Projects that are listed as exempt from conducting a mitigation assessment in the BiOp for the NFIP in Oregon. These exemptions should be listed in the community's ordinance (exempt situations are listed below in Section 1.3.1.1).
2. Project and project actions that are covered under separate consultations under Section 4(d), 7, or 10 of the ESA.
3. Projects under consideration that have already been covered by a full programmatic habitat assessment of all current and reasonably foreseeable future conditions throughout a jurisdiction. (When such an assessment already exists, and the project clearly fits within the nature and scope of those project types that were addressed by it, then the jurisdiction need only document and track how they evaluated its eligibility for coverage by that assessment).

Applicants that have coverage under Section 4(d), 7, or 10 of the ESA or through a full programmatic habitat assessment (exemptions 2 and 3 of Sections 1.3.1) should provide proof of coverage in lieu of a mitigation assessment.

Projects that require a federal permit under Section 404 of the Clean Water Act would likely need to go through an ESA consultation process led by the USACE Regulatory Branch. The Section 404 permit process includes consultation with the U.S. Fish and Wildlife Service (USFWS), and/or NMFS when a project may influence a federally listed species. Such consultation is required under Section 7 of the ESA. If a project has gone through this Section 7 process with USACE then a local MA would not be required.

A project is deemed to comply with the ESA if a permit applicant has prepared a Biological Evaluation (BE) or a Biological Assessment (BA) and has received concurrence from USFWS and/or NMFS as applicable for the species potentially present (via either a Letter of Concurrence or a BiOp) that covers the full scope of the proposed action. In such cases the additional MA requirements of this guidance are not required.

1.3.1.1 Activities Exempt from No Net Loss Standards

The following activities are not subject to the no net loss standards but may still require floodplain development permit requirements.

1. Normal Maintenance of structures, such as re-roofing and replacing siding, provided there is no change in the footprint or expansion of the roof of the structure.
2. Normal street, sidewalk, and road maintenance, including filling potholes, repaving, and installing signs and traffic signals, that does not alter contours, use, or alter culverts and is less than six inches above grade. Activities exempt do not include expansion of paved areas;
3. Routine maintenance of landscaping that does not involve grading, excavation, or filling;
4. Routine agricultural practices such as tilling, plowing, harvesting, soil amendments, and ditch cleaning that does not alter the ditch configuration provided the spoils are removed from special flood hazard area or tilled into fields as a soil amendment;
5. Routine silviculture practices (harvesting of trees), including hazardous fuels reduction and hazard tree removal as long as root balls are left in place;
6. Removal of noxious weeds and hazard trees, and replacement of non-native vegetation with native vegetation;
7. Normal maintenance of above ground utilities and facilities, such as replacing downed power lines and utility poles provided there is no net change in footprint;
8. Normal maintenance of a levee or other flood control facility prescribed in the operations and maintenance plan for the levee or flood control facility. Normal maintenance does not include repair from flood damage, expansion of the prism, expansion of the face or toe or addition of protection on the face or toe with rock armor.
9. Habitat restoration activities.
10. Pre-emptive removal of documented susceptible trees to manage the spread of invasive species.

1.4 Mitigation Assessment Overview

The mitigation assessment needs to describe existing site conditions before development occurs, as well as any impacts to floodplain functions due to actions occurring within any part of the SFHA in the BiOp's action area communities. Furthermore, the assessment must demonstrate that there will be no net loss to floodplain functions in the SFHA. Impacts to floodplain functions and mitigation to achieve no net loss are assessed using proxies for the respective functions:

- Impacts to floodplain storage are evaluated by calculating the amount of developed space that is added to the SFHA. Mitigation is calculated by the amount of undeveloped space created.
- Impacts to water quality are evaluated by calculating the amount of impervious surface that is added to the SFHA. Mitigation is calculated by the amount of pervious surface created.
- Impacts to vegetation are evaluated by calculating the number of trees larger than 6" diameter breast height (dbh) removed in the SFHA. Mitigation is calculated by the number of trees that are replaced.

1.5 Preparing and Reviewing a Habitat Assessment

This guidance provides a step-by-step approach to complete a MA when an assessment is needed. The approach described in the following sections should provide sufficient information to assess and document the impacts of proposed development in the SFHA and the mitigation required to achieve no net loss, but it does not have to be followed exactly as described. However, if a different approach is followed, it must provide sufficient data and analysis to describe existing site conditions at the time of the proposed development, impacts of proposed development in the SFHA, and the mitigation required to achieve no net loss. The guidance is not intended to provide complete instructions for documentation and justification of how a jurisdiction's existing regulations (and any planned changes to those regulations) comply with all the terms and conditions within the RPAs of the BiOp. It will be the responsibility of the jurisdiction to explain and document that information. This guidance is primarily intended to assist applicants in preparing a MA under the permit-by-permit approach listed PICM. Applicants may seek assistance from their local jurisdiction in preparation of the MA. Continued communication with community staff will also help identify issues before significant time and/or money is spent on a project that may require additional mitigation measures or needs to be redesigned or abandoned. It may be appropriate for some communities with limited staff to request assistance from their neighboring jurisdictions, Tribes, or other partners to help assess the adequacy of draft MAs written on their behalf. This guidance document allows for flexibility in the format of many aspects of the MA.

A permit applicant should weigh the cost of preparing an assessment and mitigation plan, should one be needed, against the cost of locating the project outside the SFHA. It may cost less in time and money to simply avoid the SFHA when possible.

2.0 Conducting the Assessment

The process to adequately identify and address the impacts a proposed project may have on habitat and ESA-listed species within the floodplain is described in the following sections. The first few steps are to describe the project area and the area of potential development impacts

(which may be larger). After describing the existing site conditions as they relate to the floodplain functions of floodplain storage, water quality, and vegetation, the next step is to analyze the project impacts to the existing site. When those impacts are analyzed, a mitigation plan must be prepared to achieve no net loss.

2.1 Step 1. Describe the Project Area

The project area is the portion of property, properties, easements, or right-of-way where all project-related development activities and impacts are planned to occur.. In some cases, the project may extend to a larger area, such as when a road to the parcel is to be built or improved, or when the effects of several interrelated or interdependent proposed land development actions are considered together. Producing two documents– the project area description and a project area map – would help effectively show the information required in Step 1.

2.1.1 Project Area Description

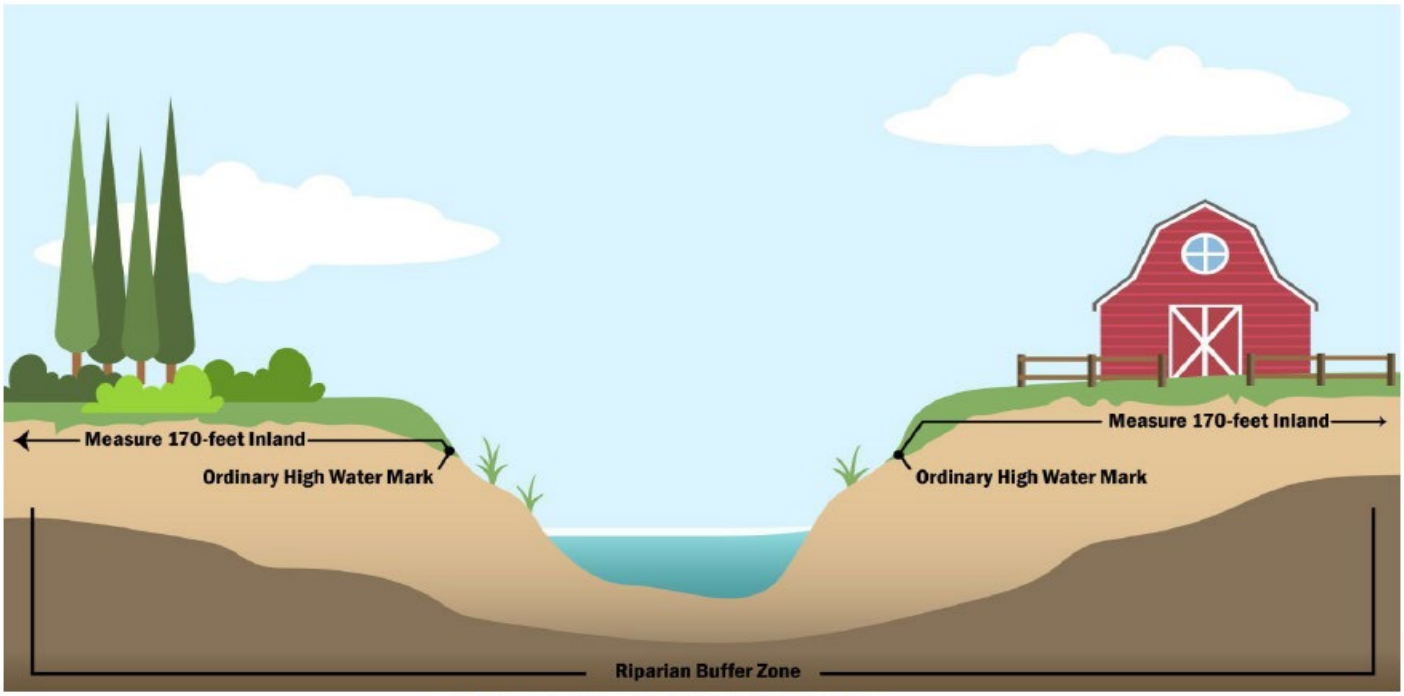
If an Oregon State Joint Permit Application (JPA) form has been prepared for the project, it will include the general project area description information that would be included as part of the habitat assessment. An approval under Section 401 of the Clean Water Act is required from the Oregon Department of Environmental Quality (ODEQ) and/or a removal-fill permit is required from the Oregon Department of State Lands (DSL). However, the JPA may not adequately describe all the natural functions, and habitat support processes, species distribution characteristics, hydrologic variables, and/or water quality effects that need to be addressed in a habitat assessment. At a minimum, this step should identify the following information:

- **Location information:**
    - Street address
    - City and County
    - Latitude and longitude
    - Tax parcel number(s) of the project location
    - Type of ownership of the project (Federal, State, or locally owned public lands; tribal lands; privately owned lands)
- **Water resource information:**
    - Watershed name based on the 5th field watershed.
        - The 8 digit Hydrologic Unit Code (HUC) is the closest equivalent HUC to the 5th field watershed.
        - Information on Oregon's watersheds can be found at the United States Geologic Service (USGS) Watershed Boundary Dataset, the Oregon Department of Environmental Quality (DEQ) Oregon 2024 Integrated Report Frequently Asked Questions, and the mapping webpage at: Oregon Explorer
        - HUC codes for the Pacific Northwest region can be found at the U.S. Geological Survey site: https://water.usgs.gov/GIS/wbd_huc8.pdf (Oregon codes can be

found starting on page 94).

- Names and descriptions of the water bodies in which work will occur, including water type. For more information on water type and a map that designates the types for major water bodies, see the Oregon State Water Resources Department water typing page: (http://www.oregon.gov/ODF/Documents/WorkingForests/WaterClassificationTechNote1.pdf)
- Hydrologic reach (See section 1.2 for definitions) of the project area. A list of examples of reaches can be found in Stream Reaches and Hydrologic Units section of the USDA National Engineering Handbook.
    - Reaches can also be determined by 11-digit HUCs.
    - Additional GIS layers to help determine reach: National Flood Hazard Layer; National Hydrography Dataset.

- **Regulatory Areas and other Site Conditions**
    - Identify if the project area is in the Regulatory Floodway, Riparian Buffer Zone (RBZ), or RBZ-fringe.
        - See Section 1.2 for definitions.
        - The RBZ must be measured 170 feet from the Ordinary High-Water Mark (OHWM) on both sides of a freshwater body or the Mean Higher-High Waterline (MHHW) of a tidally-influenced water body. Development in the RBZ must adhere to additional performance standards to achieve no net loss as outlines in section 5.2.
            - USGS Guidance for determining the OHWM can be found here.
            - The RBZ extends only as far as the SFHA, meaning, if the SFHA is smaller than 170 feet from the OHWM or MHHW then the RBZ extends only to the boundary of the SFHA.



Measuring the Riparian Buffer Zone

- Briefly describe if the area is connected or disconnected to the larger floodplain.
- Briefly describe the topography of the project area and identify the distance between existing ground level and the Base Flood Elevation (BFE).

2.1.2 Project Area Map

A project area map can help supplement the information required in Section 2.1.1 and should contain the following data:

- Parcel(s) boundaries
- Full analysis area
- Area of the finished project (including roads)
- Any additional area(s) that will be disrupted during construction (including access routes, staging areas, and areas to be re-graded or filled)
- All water bodies
- Site topography, soils, and geology
- Existing native vegetation by vegetation community zones. For example, a map could distinguish areas with existing coniferous forest cover from areas with shrub cover and areas with grass cover.
    - USGS National Land Cover Database
- Boundaries of the following regulatory areas as applicable:
    - Special Flood Hazard Area
    - Floodway

- Riparian Buffer Zone (RBZ)
- Channel Migration Zone (CMZ) (where available)

2.2 Step 2. Describe the Project Area's Habitat

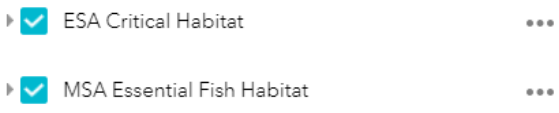
In Step 2 of the habitat assessment, the applicant describes the existing habitat conditions of the project area. For this assessment, the project area's habitat is described in relation to the three floodplain functions of floodplain storage, water quality, and vegetation and their respective proxies of undeveloped space, impervious surface, and trees.

2.2.1 Floodplain Functions

To describe the project area's existing habitat, the existing impacts to floodplain functions must be described. FEMA has developed clear and measurable actions that can help determine the existing value of the floodplain functions of floodplain storage, water quality, and vegetation. These clear and measurable actions are referred to as proxies (also described in Section 1.4 above). These proxies, when applied to development, create a positive or negative effect on the floodplain functions. Proxies for the floodplain functions are identified in the table below:

Floodplain Function	Proxy (No net loss of…)	Mitigates Against
Floodplain storage	Undeveloped space	Developed space
Water quality	Pervious surfaces	Impervious surface
Vegetation	Trees	Trees removed

- Describe the existing habitat as related to undeveloped space. Undeveloped space is defined as the volume of flood capacity and fish-accessible/egress-able habitat from the existing ground to the Base Flood Elevation that is undeveloped.
    - Identify the volumetric amount of space between the existing ground level and the BFE that meets FEMA's definition of development (see section 1.2).
    - Identify any remaining volumetric space between the existing ground level and the BFE that is not accessible/egress-able to an adult fish that is listed in the 16 ESA species identified in the 2016 NMFS BiOp.
        - In circumstances where there is no essential fish habitat documented of the 16 ESA-listed fish species, fish accessibility and egress-ability do not have to be considered in the steps of this Mitigation Assessment. The Mitigation Assessment must include this scientifically supported documentation.
            - Documentation can be found on the NOAA Species and Habitat Map. Documentation must demonstrate that development and development-related impacts are occurring outside of both ESA Critical and MSA Essential Fish Habitat.



    - The sum of these volumetric space calculations is the existing site habitat related to floodplain storage.
- Describe the existing habitat as related to impervious surfaces by calculating the total square footage of impervious surfaces in the project area.
    - This calculation is the existing site habitat related to water quality.
- Describe the existing habitat as related to the number of trees in the project area by identifying the quantity of trees and their respective size (in inches) measured at diameter breast height (dbh).
    - Identify the number of trees on the project area, their size, and if they will be affected by the proposed project. Identifying trees by species is helpful for establishing site conditions, but not necessary in this step.
    - This identification is the existing site habitat related to vegetation.

2.2.2 Protected Species Identification

As part of the outcome of the 2016 NMFS BiOp, development within the floodplains of the Oregon NFIP-ESA implementation area has been found to cause a "Likely to Adversely Affect" (LAA) determination for 16 ESA-Listed species and the Southern resident killer whale (see Section 1.1 for list of species).

Because of this determination, an applicant does not have to separately identify endangered species within the project area, as they have already been identified in the BiOp. An applicant can safely assume that development would adversely affect at least one of the aforementioned species and that mitigation prescribed later in this document is sufficient to achieve no net loss and therefore ESA compliance for the project.

There are no further steps required within this step of the assessment process. However, if an applicant believes that their proposed floodplain development has none of the 16 ESA-listed fish species and the Southern resident killer whale in the project area and that development would create no adverse effect through indirect, and/or cumulative downstream effects to said species, they can complete a full Habitat Assessment through following steps 1-6 identified in the latest version of *Floodplain Habitat Assessment and Mitigation: Regional guidance for Oregon,* available on FEMA's website. Habitat assessments with an effects determination outcome of "No effect" or "Not likely to adversely affect" would not require mitigation to achieve no net loss. Habitat assessments with an effects determination outcome of "Likely to Adversely Affect", however, would still require no net loss.

2.3 Step 3. Describe the Project

There are two key parts of the project that need to be described at this stage of the assessment report: 1) the final project, i.e., what the area will look like and how it will be used when the project is completed; and 2) the construction process that will be followed to get there. Measures taken by the proponent to avoid, minimize, replace, or compensate (the descending order of

preference of the mitigation sequence) for degradation to the habitat functions must be described in enough detail to allow assessment of all impacts of the proposed action.

All features of the proposed completed project as well as impacts during the construction process must be described. This includes, but is not limited to:

- Applicant, project title, permit number, project description, and project status;
- Project location and size of project in SFHA, Riparian Buffer Zone (RBZ), and Riparian Buffer Zone Fringe (RBZ-Fringe);
- Location where mitigation (when applicable) is intended to occur;
- Volume of developed space added in the SFHA and compensatory storage used in mitigation;
- Acres disconnected and reconnected to/from the floodplain;
- Amount of new impervious surface added;
- Type, amount, and description of water quality mitigation provided;
- Number of trees removed and their size;
- Ecoregion where development impacts occurred;
- Number of trees planted and species type;
- Area of native herbaceous and shrub vegetation planted (as related to the beneficial gain standard).

The level of detail needed for these descriptions will vary according to the nature, scope, and scale of the project, and its location relative to ESA-listed species and their potential habitats. Assessments should include as much information as is needed to adequately describe and estimate potential project impacts. In some cases, there may be little or no potential for adverse effects; therefore, in those cases, it may require relatively less information and discussion to document potential effects.

Project details, nearby stream courses, and any key floodplain features can be mapped, as long as the map sufficiently shows the project-related impacts identified above.

2.4 Step 4. Assess the Environmental Effects

The 2016 NMFS BiOp has determined that development actions in the Special Flood Hazard Area is likely to adversely affect the 16-ESA listed species, the Southern Resident killer whale, and essential fish habitat (See Section 1.1). Therefore, no further effects determinations are required, and it is assumed that mitigation will be required for development to achieve no net loss of key floodplain functions.

If an applicant believes that their project does not create an adverse effect of the floodplain functions through direct, indirect, and cumulative impacts, they would need to follow steps 1-6

identified in the latest version of *Floodplain Habitat Assessment and Mitigation: Regional guidance for Oregon* and the criteria identified in Section 2.2.2.

2.4.1 No Net Loss Determination

Actions in the SFHA of the implementation plan area will have a "Likely to Adversely Affect" determination on the identified ESA-listed species. However, the RPAs set forth in the 2016 BiOp and 2017 errata allow for compensatory mitigation of adverse effects within the SFHA through mitigation with no net loss standards. No net loss is a standard where adverse impacts must be avoided or offset through mitigation so that there is no net change in function from the condition when development begins. The no net loss standards ensure that the implementation of the NFIP avoids jeopardy of listed species and adverse modification of habitat, including essential fish habitat under the jurisdiction of NMFS within the plan area. They apply to the three floodplain functions (i.e., floodplain storage, water quality, and riparian vegetation) essential to the survival of the 16 ESA-listed fish species and Southern Resident killer whale in the plan area.

2.4.2 Preparing the Mitigation Plan

The following sections (Steps 5 and 6) provide guidance on preparing a mitigation plan, including reference to any other pertinent habitat-specific restoration and mitigation guidance materials developed for the area under consideration. The final objective of floodplain habitat mitigation is to ensure that there is no adverse effect on quality or quantity of natural habitat functions and processes within the Special Flood Hazard Area through no net loss standards. Step 5, Task 2.5.3 of this guidance provides guidance on mitigation objectives to achieve no net loss, including specific requirements for mitigation within riparian buffer zones and through the remainder of the SFHA.

For many development proposals, the permit conditions and mitigation actions required to meet other local and state permit requirements may also provide sufficient mitigation for the impacts identified through Step 4 of this guidance. In such instances, permit conditions and required mitigation actions may overlap to serve as mitigation for impacts on floodplain habitats, as required by the local floodplain management ordinance. However, the conditions and mitigation proposed, must be sufficient to mitigate for all floodplain habitat impacts, in order to meet the objective of no net loss on the floodplain functions of floodplain storage, water quality, and vegetation for ESA-listed species.

2.5 Step 5. Review Mitigation Alternatives (Mitigation Sequencing)

There are three major types of mitigation approaches to rectify an adverse effect. In descending order of preference and effectiveness they are: avoidance, minimization, and mitigation. Mitigation is the only approach required to achieve no net loss and ESA compliance, but avoidance and minimization will help make the mitigation required to achieve this easier.

2.5.1 Avoidance

Avoidance of adverse effects is the preferred approach, but is not required. FEMA recommends that new land development actions remain outside of the SFHA. Avoidance prevents additional

adverse effects on aquatic and riparian habitats, while also precluding any risks to public safety and property from increased frequency, duration, or magnitude of flooding that would possibly result from further development in the floodplain. Avoidance also largely eliminates the expense of adhering to no net loss within the SFHA. The permit applicant should strongly consider relocating or redesigning proposed projects to minimize the impacts on floodplain habitat functions and the corresponding need for a mitigation plan.

Communities should consider disincentivizing development within the floodplain. Many communities currently use a variety of strategies to encourage conservation of sensitive areas by allowing for development at a more intense level in other areas. These measures are usually implemented through provisions of a zoning ordinance or separate development regulations. Here are three incentives for floodplain conservation that some jurisdictions use:

1. Providing density incentives to individual property owners: A density incentive or density credit system would allow specified land uses to occur at a more intense level within the portion of a parcel outside of the floodplain as compensation for conservation of flood-prone areas within the parcel. For example, if a 20-acre parcel is zoned for one acre lots and half of the parcel is in the floodplain, the community might consider allowing the ten "dry" acres to be developed with half acre lots, allowing the developer to still construct 20 homes. This would allow for a higher density of development in a portion of the property and would require the remaining, high-habitat-value floodplain to be conserved as a dedicated tract. This strategy is similar to the approach of clustering development, which is provided as a case study in Figure 6-3 of the FEMA 480 manual "Floodplain Management Requirements" and is often used in planned unit developments. Under either the density incentive or density credit approach, the overall project does not exceed the development density allowed by the zoning district.
2. Transfer of development rights: Transfer of development rights (TDR) programs allow for the transfer of development density from one parcel of land (with some conservation value, such as a floodplain or wetland) to another parcel or area that is planned for higher density development. Implementation and administration of TDR systems has proven challenging in many circumstances due to the required coordination in establishing density receiving and density giving areas and the required negotiation to set density credit values. However, a community, regional, or watershed-based TDR system may be a successful strategy for floodplain avoidance.
3. Tax relief for conservation lands: Tax relief is a financial incentive proven to help discourage development of sensitive lands. Such systems could provide an additional venue to encourage conservation of floodplain lands. However, tax relief systems generally do not provide permanent protection for natural resources as they often are terminated when the property ownership transfers.

2.5.2 Minimization

If the entire project cannot avoid some development within the SFHA, it may be able to minimize the physical area and magnitude of impacts on the three floodplain functions. Some ideas for minimizing impacts include:

- Elevating structures in the SFHA on posts and piers to reduce the amount of fill/structure volume below the BFE.
- Reducing the amount of new impervious surface and using pervious surfaces where possible.
- Reducing the number of trees with a dbh of 6 inches or larger to be removed.

Many adverse effects result from degradation of natural processes or functions caused by actions during the construction period. Some best management practices to avoid these types of impacts include, but are not necessarily limited to:

- Perform all work in dry weather and/or during the dry season.
- Incorporate erosion and sedimentation control measures.
- Use vegetable oil-based hydraulic fluids in all equipment working in water.
- Prepare and train crews on a spill prevention and pollution control plan and require that all equipment needed to contain a possible spill is available on-site before construction activities begin.
- Store, stage, and refuel equipment outside the riparian buffer zone.
- Inspect equipment daily for leaks.
- Time specific phases of work to occur during "special work windows," when the species are not present or will not be affected.

2.5.3 Mitigation

Mitigation must be conducted for any loss to floodplain storage, water quality, and riparian vegetation in the SFHA. This is measured in PICM through an increase in fill or structures below the BFE, an increase in impervious surfaces, and the removal of trees 6 inches dbh or higher. Mitigation may include both natural methods (e.g., replanting of trees) or engineered methods (e.g., green infrastructure) depending on the floodplain function impacted.

Mitigation is recommended to occur on the same site and reach as which the impact occurs. Mitigation that does not occur within the same reach as where impacts occurred is subject to higher ratios that increase mitigation required to achieve no net loss. Mitigation must occur within the same watershed (i.e., the 5th field watershed). Mitigation for impacts to floodplain functions must occur before, or at the very least, concurrent with the loss of the function. For communities within the plan area of Oregon's BiOp, FEMA requires that all development in the

SFHA be mitigated to achieve no net loss of the natural floodplain functions of floodplain storage, water quality, and vegetation through the ratios below.

Basic Mitigate Ratios	Unoccupied Space (ft^3)	Pervious Surface (ft^2)	Trees (6"<dbh≤20")	Trees (20"<dbh≤39")	Trees (39"<dbh)
Floodway and/or RBZ	2:1	1:1	3:1	5:1	6:1
RBZ-Fringe	1.5:1	1:1	2:1	4:1	5:1
Mitigation multipliers					
Mitigation onsite to Mitigation offsite, same reach	100%	100%	100%	100%	100%
Mitigation onsite to Mitigation offsite, different reach, same watershed (5^{th})	200%	200%	200%	200%	200%

Table 2: Mitigation Ratios Required to Achieve No Net Loss

Mitigation multipliers of 100% result in the required mitigation occurring at the same value described by the ratios above, while multipliers of 200% result in the required mitigation being doubled.

- For example, if only 500 ft^2 of the total 1000 ft^2 of required pervious surface mitigation can be conducted onsite and in the same reach, the remaining 500 ft^2 of required pervious surface mitigation occurring offsite at a different reach would double as a result of the 200% multiplier.

2.5.3.1 Mitigating to Create Undeveloped Space

Undeveloped space (see Section 1.2 for definition) mitigation is required when flood storage volume and/or fish accessible and egress-able space is impacted. Development actions that displace flood storage volume or restrict the access of either a juvenile or adult of the 16-ESA listed species' (excluding the Southern Resident killer whale) essential fish habitat.

- Additional guidance for fish access and egress-ability may be derived from the following documents below:
  - NOAA Fish Screening Criteria for Anadromous Salmonids
  - California NRA 2023 Floodplains Reimagined Program Phase I: The Landscape Scale Multi-Benefit Floodplain Feasibility Study Project Opportunities, Constraints, and Considerations: OppsConstraintsTM_FINAL.pdf
  - USGS 2018. Survival, travel time, and utilization of Yolo Bypass, California, by outmigrating acoustic-tagged late-fall Chinook salmon.

Un/developed space is measured only in the area between the existing ground level and the BFE. This mitigation applies only when there is a net increase of developed space to the project area's footprint.

- For example: If 1,000 cubic feet of existing developed space is removed, but 1,200 ft3 of developed space is added, only 200 ft3 of developed space would have to be mitigated by the ratios.
- No net loss applies only when there is loss. If undeveloped space is being created at the same volume as the developed space being added to the floodplain, there is no change in footprint, no loss of floodplain functions, and therefore no adverse impact to floodplain function.

Undeveloped space created to achieve no net loss must be hydrologically connected to the floodplain, designed to not increase flood velocity, and designed to fill and drain the impacted area to minimizes fish stranding and entrapment to the greatest extent possible.

Mitigation to create undeveloped space can include, but is not limited to:

- Removing existing developed space from the SFHA;
- Creation of swales designed to minimize fish stranding;
- Grading; and
- Creating undeveloped space on a communal parcel or lot.

2.5.3.2 Mitigating Against Impervious Surfaces Added

Mitigating the addition of impervious surfaces due to development actions can be achieved in three ways. An applicant can mitigate any addition of impervious surface using the 1:1 ratio as prescribed in the table above. For every one square foot of impervious surface added in the SFHA due to development, one square foot of pervious surface must also be created. This is commonly done through removal of existing impervious surface. It is dependent on the communities to determine criteria on surfaces with varying levels of permeability, however, impervious surfaces must meet FEMA's definition of impervious surface (see Section 1.2 Definitions).

In instances where pervious surface replacement is not possible (such as in scenarios where there are no pre-existing impervious surfaces to remove), mitigation can be achieved through infiltration of stormwater using low impact development (LID) or green infrastructure practices (e.g., rain gardens, bioswales). LID and green infrastructure practices by nature minimize the amount of impervious surface added in the project area, but also mitigate any remaining impervious surfaces that remain. For example, a structure that uses rain-catchment systems as designed by a qualified professional mitigates any impervious surfaces that the structure creates as it helps to capture the pollutants and runoff that would otherwise flow into the waterbody. Additional guidance LID and green infrastructure practices can be found here:

- Oregon Department of Environmental Quality (DEQ) Template for LID Stormwater Manual for Western Washington

    - Chapter 3 provides Best Management Practice Designs
- Central Oregon Intergovernmental Council Central OR Stormwater Manual
    - Appendix 11B: Low-Impact Development

When neither pervious surface replacement or LID and green infrastructure practices are possible, due to impermeable soils or high-water tables, stormwater detention and retention is required to ensure no increase in peak volume of flow, followed by treatment to minimize pollutant loading. Stormwater retention and detention must abide by the following criteria:

- Water quality (pollution reduction) treatment for post-construction stormwater runoff from any net increase in impervious area; and
- Water quantity treatment (retention facilities) unless the outfall discharges into the ocean. Retention facilities must also:
    - Limit discharge to match the pre-development peak discharge rate (i.e. the discharge rate of the site based on its natural groundcover and grade before any development occurred) for the 10-year peak flow using a continuous simulation for flows between 50% of the 2-year event and the 10-year flow event.
    - Treat stormwater to remove sediment and pollutants from impervious surfaces such that at least 80% of the suspended solids are removed from the stormwater prior to discharging to the receiving water body.
    - Be designed to not entrap fish and drain to the source of flooding.
    - Be certified by a qualified professional.
- Stormwater treatment practices for multi-parcel facilities and subdivisions, shall have an enforceable operation and maintenance agreement to ensure the system functions as designed, including:
    - Access to stormwater treatment facilities at the site by the community for the purpose of inspection and repair.
    - A legally binding document specifying the parties responsible for the proper maintenance of the stormwater treatment facilities. The agreement will be recorded and bind subsequent purchasers and sellers even if they were not party to the original agreement.
    - For stormwater controls that include vegetation and/or soil permeability, the operation and maintenance manual must include maintenance of these elements to maintain the functionality of the feature.
    - The responsible party for the operation and maintenance of the stormwater facility shall have the operation and maintenance manual on site and available at all times. Records of the maintenance and repairs must be retained and made available for inspection by the community for five years.

2.5.3.3 Mitigating for Trees Removed

Mitigating for trees 6" dbh or greater requires mitigation prescribed by ratios in the table above. The ratios above operate under the assumption that replacement trees will be saplings or tree sizes commonly found at local nurseries. When mitigating for trees removed from the project area, replacement trees must be native species occurring naturally in the Level III ecoregion where the mitigation is occurring. Guidance for determining Level III ecoregions can be found below:

- Level III and IV Ecoregions of the Continental United States, US Environmental Protection Agency

2.5.3.4 Mitigating in the Riparian Buffer Zone

In addition to higher mitigation ratios established by the no net loss standards, development in the RBZ is subject to the Beneficial Gain Standard:

Under the Beneficial Gain Standard, project impacts occurring within the RBZ must be mitigated by planting a mix of native and riparian herbaceous, shrub, and tree vegetation. This mitigation must occur within the same hydrologic reach of the project impact and must be equivalent to 5% of the total project area within the RBZ that has been impacted by development.

- The following activities are exempt from the Beneficial Gain Standard:
    - Activities considered exempt from No Net Loss (see Section 1.3.1.1).
    - Activities considered Functionally Dependent Uses (see Section 1.2 for definition)
        - Functionally Dependent Uses include:
            - Docking and port facilities necessary for the loading and unloading of cargo or passengers; and
            - Ship building and ship repair facilities.
        - Functionally dependent uses **do not** include:
            - Long-term storage
            - Related manufacturing facilities
            - Ancillary features such as restrooms or lounge areas

2.6 Step 6. Prepare the Mitigation Assessment

2.6.1 Objective

As noted in Step 5, the objective of the mitigation assessment is to assure that actions are taken to sufficiently and appropriately mitigate for negative impacts on ESA-listed populations and the natural functions and processes that support their habitats. The mitigation plan needs to provide sufficient detail to demonstrate how this will be done to achieve No Net Loss.

For all mitigation, the final plan (construction level detail) should not be drafted until the local permitting office(s), in coordination with state and federal agencies, as necessary, has agreed that the conceptual mitigation plan would meet the objectives.

2.6.2 Format

A mitigation assessment should adequately describe the existing site conditions, the impacts to the project area from the proposed action, and the mitigation required to achieve no net loss. An assessment could be done through a narrative, site maps, or any other documents that sufficiently describe the steps above. Here is an example mitigation plan outline:

1. Introduction, background, objectives
2. The project area and existing site conditions (taken from Step 1 of the assessment)
3. The project area's habitat as related to the three floodplain functions (taken from Step 2 of the assessment)
4. Project description (taken from Step 3 of the assessment)
5. Impact on habitat and ESA-listed species (taken from Step 4 of the assessment)
6. Mitigation measures applied to achieve no net loss (taken from Step 5 of the assessment)

3.0 Reviewing Mitigation Assessments

This section provides guidance for the local permit official. The following strategies may be used to ensure that habitat assessments and mitigation plans are prepared by a qualified individual or company and meet the intent of the Model Ordinance and this guidance.

Establishing a List of Qualified Professionals: The community could provide a list of qualified professionals who have experience in the area to developers and landowners. Another strategy for ensuring that qualified consultants are used could include developing qualification criteria for authors of habitat assessments and mitigation plans; see the box below for an example of qualifying criteria.

Third Party Review: The community may establish a system of third-party review(s) by qualified professionals or agencies. Third party review is frequently implemented by local jurisdictions for environmental permits and approvals. The cost of third-party review could be passed on to the applicant. This may require establishment of a third-party review system in the

local ordinance. Establishing a system of third party review could augment internal review within the local jurisdiction. Another option that may work for certain jurisdictions could be formalizing a system of internal review where qualified staff would determine the adequacy of submitted materials.

3.1 Review Checklists

Permit staff could develop a review checklist for assessment and mitigation plan submittals. A checklist would likely need to be tailored to specific types of development activity due to the site and habitat-specific nature of habitat assessments and mitigation plans.

Example Qualification Criteria

The following criteria could be used by a community as part (likely not all) of the minimal criteria needed to conduct habitat assessment to ensure assessments and mitigation plans are prepared by a qualified consultant:

Reports and plans shall be prepared by persons who have a minimum of a bachelor's degree in wildlife or fisheries habitat biology, or a related degree in a biological field from an accredited college or university with a minimum of four years' experience as a practicing fish or wildlife habitat biologist.

Qualifying criteria should include further specifications for all wildlife, fisheries, habitat, and environmental professionals that could be relied upon to address the broad array of habitats and conditions that occur in flood-prone areas.

4.0 References and Resources

4.1 Federal and State Regulations and Guidance

- *National Flood Insurance Program- Endangered Species Act Integration in Oregon*, FEMA Region 10. https://www.fema.gov/about/organization/region-10/oregon/nfip-esa-integration
- *CRS Credit for Habitat Protection,* FEMA, 2010. http://training.fema.gov/EMIWeb/CRS/
- *Endangered Species Consultation Handbook,* National Marine Fisheries Service, 1998.
- https://media.fisheries.noaa.gov/dam-migration/esa_section7_handbook_1998_opr5.pdf
- *Endangered Species Act (ESA) Section 7(a)(2) Jeopardy and Adverse Modification of Critical Habitat Biological Opinion, ESA Section 7(a)(2) "Not Likely to Adversely Affect" Determination, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Implementation of the National Flood Insurance Program in the State of Oregon.* April 14, 2016. https://media.fisheries.noaa.gov/2022-01/2016-04-14-fema-nfip-nwr-2011-3197.pdf
- *Mitigation guidance and JPA permit information,* Oregon State Department of Lands. http://www.oregon.gov/DSL/WW/Pages/Permits.aspx
- *National Flood Insurance Program Floodplain Management Requirements A Study Guide & Desk Reference for Local Officials*, FEMA 480, 2005. https://library.floods.org/cgi-bin/koha/opac-detail.pl?biblionumber=5219

4.2 Maps and Databases

Critical habitat maps:

- United States Geologic Service (USGS) Watershed Boundary Dataset
- U.S. Geological Service HUC codes in the Pacific Northwest: https://water.usgs.gov/GIS/wbd_huc8.pdf
- National Marine Fisheries Service: http://www.nmfs.noaa.gov/pr/species/criticalhabitat.htm
- U.S. Fish and Wildlife Service: http://criticalhabitat.fws.gov/
- http://www.oregon.gov/ODF/Documents/WorkingForests/WaterClassificationTechNote1.pdf
- *Threatened and Endangered Species List,* Oregon Department of fish and Wildlife. http://www.dfw.state.or.us/wildlife/diversity/species/threatened_endangered_candidate_list.asp
- *Oregon Natural Heritage Program,* Oregon State University Institute for Natural Resources. http://inr.oregonstate.edu/orbic
- Oregon State Soil Survey data, see the USDA Natural Resource Conservation Service

maps or online *Web Soil Survey*. http://websoilsurvey.nrcs.usda.gov/app/

- *Regional Guidance for Hydrologic and Hydraulic Studies in Support of the Model Ordinance for Floodplain Management under the National Flood Insurance Program and the Endangered Species Act,* FEMA Region 10, 2010. https://www.fema.gov/pdf/about/regions/regionx/draft_handh_guide.pdf
- Oregon Department of Environmental Quality (DEQ) Oregon 2024 Integrated Report Frequently Asked Questions
- Oregon State Water Resources Department water typing page: (http://www.oregon.gov/ODF/Documents/WorkingForests/WaterClassificationTechNote1.pdf)
- Stream Reaches and Hydrologic Units: https://nrcspad.sc.egov.usda.gov/DistributionCenter/pdf.aspx?productID=554.

4.3 Water Quality and Quantity

- *Section 401 Water Quality Certification: Post-Construction Stormwater Management Plan Submission Guidelines,* State of Oregon Department of Environmental Quality, 2016,
- https://www.oregon.gov/deq/wq/wqpermits/Pages/Section-401.aspx
- Standards for surface water quality in Oregon State, Department of Environmental Quality. http://www.oregon.gov/deq/wq/Pages/WQ-Standards.aspx
- *Routine Road Maintenance | Water Quality and Habitat Guide, Best Management Practices,* State of Oregon Department of Transportation, 2020. http://www.oregon.gov/ODOT/GeoEnvironmental/Pages/Stormwater.aspx
- *Oregon State Water Quality Assessment*, Department of Environmental Quality.
- http://www.oregon.gov/deq/wq/Pages/WQ-Standards.aspx
- Water level data:
    - U.S. Geological Survey: http://wa.water.usgs.gov/data/

4.4 Mitigation

- *Engineering with Nature − Alternative Techniques to Riprap Bank Stabilization*, FEMA Region 10, 2009. https://www.fema.gov/pdf/about/regions/regionx/Engineering_With_Nature_Web.pdf
- *Habitat Conservation Planning Handbook*, US Fish & Wildlife Service and National Marine Fisheries Service, 1996. https://www.fws.gov/library/collections/habitat-conservation-planning-handbook
- Pu*rpose of Mitigation and Mitigation Steps in Oregon State,* Oregon State Department of State Lands. http://www.oregon.gov/dsl/WW/Pages/Mitigation.aspx
- *Wetland Mitigation Banking Guidebook for Oregon: Approval Process and*

Documentation, Oregon Division of State Lands, 2000, http://oregonexplorer.info/data_files/OE_topic/wetlands/documents/mitbank_guidebk.pdf

- *A Guide to the Removal-Fill Permit Process: Compensatory Mitigation Planning,* Oregon Division of State Lands, 2016, https://www.oregon.gov/dsl/wetlands-waters/Documents/Removal_Fill_Guide.pdf
- *Oregon Aquatic Habitat: Restoration and Enhancement Guide,* Oregon Plan for Salmon and Watersheds, 1999, https://digital.osl.state.or.us/islandora/object/osl:16552

4.5 Additional References

- BiOp and RPA for Oregon
- California NRA 2023 Floodplains Reimagined Program Phase I: The Landscape Scale Multi-Benefit Floodplain Feasibility Study Project Opportunities, Constraints, and Considerations: OppsConstraintsTM_FINAL.pdf
- Invasive species information: Oregon Department of Agriculture. http://www.oregon.gov/ODA/programs/Weeds/Pages/AboutWeeds.aspx
- NOAA Fish Screening Criteria for Anadromous Salmonids
- USGS National Land Cover Database
- USGS 2018. Survival, travel time, and utilization of Yolo Bypass, California, by outmigrating acoustic-tagged late-fall Chinook salmon.