PRIVATE FOREST ACCORD

— 2022 —

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Cover and illustration: Gareth Curtiss

CHAPTER 1: INTRODUCTION

1.0 Introduction

This Private Forest Accord Report (the Report) is presented to the Oregon Legislature, Oregon Governor Kate Brown, and the Oregon Board of Forestry on February 2, 2022. It memorializes the agreements of the Authors (see below) to modify Oregon's forest practice laws and regulations to craft a Habitat Conservation Plan (HCP) that will achieve the issuance criteria of an Incidental Take Permit (ITP) under Section 10 of United States Endangered Species Act for the Covered Species (as defined in Section 1.4.1). These agreements are collectively known as the Private Forest Accord (PFA) and were the result of negotiations that concluded on October 30, 2021. The PFA negotiation process was established under the February 10, 2020 Memorandum of Understanding (the MOU), then formalized and funded through passage of SB 1602 (2020).

This Report is presented in conjunction with SB 1501, SB 1502, and HB 4055, and the agreements herein are to be implemented through the resulting statutory language of those bills and the administrative rules called for by the above bills and identified in this Report. It is the intention of the Authors that all rules promulgated to implement the Private Forest Accord will be consistent with the agreements contained in this Report.

1.1 Background

1.1.1 The Memorandum of Understanding

On February 10, 2020, 12 forest sector companies, Oregon's largest small woodlands owner organization, and 13 conservation and fishing organizations signed a Memorandum of Understanding (the MOU), which laid the foundation for the Private Forest Accord process. Prior to signing the MOU, the signatories were embroiled in a costly and unpredictable battle over competing initiative petitions that would appear on the November 2020 ballot. The 2020 voter initiatives followed on the heels of decades of fierce debate between the forest products sector and the conservation and fishing community about how to adequately manage privately owned forestlands to achieve a range of outcomes. These debates resulted in deeply entrenched political camps, which in turn often made achieving meaningful policy objectives difficult.

The MOU was a good-faith effort by both the forest products sector and the conservation and fishing community to find collaborative approaches to resolving the numerous conflicts that were embodied in the initiative petitions. A copy of the MOU is attached to this Report as Appendix A.

The MOU included three substantive agreements:

1. The signatories agreed to work collaboratively to pass aerial pesticide application legislation consistent with the term sheet attached to the MOU as Exhibit B. This legislation was included in SB 1602, which was passed by the Oregon House and Senate during the 2020 First Special Session and subsequently signed into law by Governor Brown. The legislation increased buffers around homes, schools, water intakes, and streams for helicopters applying pesticides. It also created a first-in-the-nation electronic notification system that allows neighbors to obtain notice prior to a planned aerial pesticide application, as well as notice of completion of activities.

2. The signatories agreed to support legislation instructing the Board of Forestry to extend the 2017 salmon, steelhead, and bull trout (SSBT) stream rules to the Siskiyou Georegion at the soonest possible date. This expansion was also passed into law through SB 1602.

3. The signatories agreed to participate in "a science-informed policy development process, rooted in compromise, to evaluate and jointly recommend substantive and procedural changes to Oregon forest practice laws and regulations" (p. 2). The goal of this process was to "finalize a plan to prepare an application to the federal services through changes to Oregon's Forest Practices Act and implementing regulations that will provide a rational basis for an approvable Habitat Conservation Plan, or other mechanism for federal regulatory assurances, covering listed salmonids and other aquatic and riparian-dependent species" (p. 2). The MOU limited the identified process to 18 months and required that any potential agreements would be reached before the 2022 legislative session. This process was formalized and funded through the passage of SB 1602, and would become the Private Forest Accord process.

In addition to supporting the above, the MOU signatories also agreed to abide by various ground rules during the Private Forest Accord process. MOU signatories were not required to support the final outcome of the Private Forest Accord process, and failure of the process was always a strong possibility.

1.2 The Private Forest Accord

1.2.1 Authors of the PFA Report

The Authors of this Report are a subset of signatories to the February 10, 2020 Memorandum of Understanding (the MOU) that established the foundation for the PFA process. The Authors consist of 1) a coalition of prominent conservation and fishing groups (Conservation Coalition) and 2) a coalition of prominent Oregon forest sector companies and the Oregon Small Woodlands Association (Working Forest Coalition).

The Authors are listed in the table below:

Conservation Coalition Authors	**Working Forest Coalition Authors**
Audubon Society of Portland	Campbell Global
Beyond Toxics	Greenwood Resources
Cascadia Wildlands	Hampton Lumber
Klamath Siskiyou Wildlands Center	Lone Rock Resources
Northwest Guides and Anglers	Manulife Timberland and Agriculture (Hancock Natural Resource Group)
Oregon League of Conservation Voters	Oregon Small Woodlands Association
Oregon Stream Protection Coalition	Port Blakely
Oregon Wild	Rayonier
Pacific Coast Federation of Fishermen's Associations	Roseburg Forest Products
Rogue Riverkeeper	Seneca Sawmill/Sierra Pacific Industries
Trout Unlimited	Starker Forests
Umpqua Watersheds	Weyerhaeuser Company
Wild Salmon Center	

1.2.2 Sponsors of the PFA Process

The Private Forest Accord was facilitated by Governor Kate Brown, with the assistance of her staff and outside mediators, and with direction and support from the Oregon Legislature.

1.2.3 Participating Agencies

Throughout the Private Forest Accord process, the Authors interfaced with various federal and state agencies. The agencies that substantively participated and provided guidance during the process are identified in the following table:

Participating State Agencies	Participating Federal Agencies
Oregon Department of Environmental Quality (DEQ)	National Marine Fisheries Service (NMFS)
Oregon Department of Fish and Wildlife (ODFW)	United States Fish and Wildlife Service (USFWS)
Oregon Department of Forestry (ODF)	

1.3 Goals of the PFA

The Authors of this Report utilized a collaborative process balancing biological and economic goals to develop practical solutions to avoid, minimize, and mitigate the effects of timber harvest, stand management, road system management, and other activities regulated under the Oregon Forest Practices Act on Covered Species and aquatic habitats. These strategies were developed to improve and protect functions in riparian areas and on steep slopes, including the recruitment of large wood, removal of fish passage barriers, and protection from increased sediment delivery and temperature. These discussions have culminated in the agreements outlined in this Report.
The goals pursued during the Private Forest Accord process are as follows:

- **Provide greater business certainty:** Provide a greater level of certainty to forest landowners and industries that depend on Oregon's private working forests without compromising the viability of Oregon's manufacturing infrastructure.
- **Provide greater environmental certainty:** Provide a greater level of certainty for the survival and recovery of threatened and endangered species and for the protection of aquatic resources.
- **Provide greater regulatory certainty:** Submit a supportable application to National Marine Fisheries Service (NMFS) and the United States Fish and Wildlife Service (collectively the "Federal Services") to achieve a programmatic aquatics HCP, which in turn will yield the issuance of an Incidental Take Permit (ITP) and enhance habitat for covered species.
- **Provide science-driven adaptive management process:** Support the certainty and durability of Oregon's forest practices laws concerning private forestland and regulations

through the establishment of an Adaptive Management Program that involves a rigorous look at the efficacy of existing and future forest practice regulations, and a science-driven process for analyzing the need for any changes.

- **Provide alternatives for small forestland owners:** Address the potential disproportionate impacts that regulatory changes might have on small forestland owners and provide alternative compliance paths and/or financial impact mitigation for these potential disproportionate impacts.

1.4 The PFA Process

As established under the MOU, the signatories agreed to a series of mediated meetings over an 18-month period to develop a final plan that would result in legislation for the 2022 legislative session. The PFA process began in late 2020 when Peter Koehler was hired as a mediator, using funds made available by SB 1602. Soon thereafter, the Conservation and Working Forest Coalitions began meeting separately with Mr. Koehler. Each coalition appointed six representatives to directly participate in the mediations. Starting on January 12, 2021, and led by Governor Brown, representatives from the two coalitions began meeting together in sessions mediated by Mr. Koehler. As a result of the COVID-19 pandemic, meetings generally occurred virtually.

As the process developed, numerous subgroups were formed to address specific issues. These subgroups included the following: riparian areas, steep slopes, roads, mitigation, small forestland owners, funding, amphibians, east side issues, and adaptive management. Most subgroups met for two hours on a weekly or bi-weekly basis through much of 2021. Multiple other meetings were facilitated to address issues such as beaver management. In addition to the issue-focused subgroup meetings, coalition representatives engaged jointly in all-day meetings periodically throughout 2021. Many subgroup and joint meetings benefitted from attendance by staff from the National Marine Fisheries Service, United States Fish and Wildlife Service, Oregon Department of Forestry, Oregon Department of Fish and Wildlife, Oregon Department of Environmental Quality, as well as numerous contractors hired by both coalitions.

Over the 18-month period, the Authors and their representatives investigated the scientific needs of the species at issue, as well as the scientific rationales, operational implications, and economic feasibility of various prescriptions and approaches. The Authors also explored numerous other scientific and policy issues related to private forest management.

To meet deadlines for the required 2022 legislative session, coalition representatives met in Portland from October 25 to 29, 2021. Governor Brown and several members of her staff attended much of that negotiation. Early in the morning of October 30, 2021, agreement was reached on the Private

Forest Accord prescriptions. Those prescriptions were memorialized in a term sheet and a series of chapters that were released to the public shortly after their signature. The term sheet and chapters that were agreed to on October 30, 2021, are the basis of this Report.

1.4.1 Covered Species Agreement

The Authors will support a Habitat Conservation Plan and application for an Incidental Take Permit, consistent with this Report, for the Covered Species. The Authors further agree that the term of the HCP should be 50-years for fish species and 25- years for amphibian species. The Covered Species shall include the following:

- All native salmon and trout (*Oncorhynchus spp*.)
- Bull trout (*Salvelinus confluentus*)
- Mountain whitefish (*Prosopium williamsoni*)
- Pacific eulachon/smelt (*Thaleichthys pacificus*)
- Green sturgeon (*Acipenser medirostris*)
- Columbia torrent salamander (*Rhyacotriton kezeri*)
- Southern torrent salamander (*Rhyacotriton variegatus*)
- Coastal giant salamander (*Dicamptodon tenebrosus*)
- Cope's giant salamander (*Dicamptodon copei)*
- Coastal tailed frog (*Ascaphus truei*)

It is anticipated that the HCP application process will further develop the definition of Covered Species, consistent with the above intent.

1.4.2 Covered Activities Agreement

The Authors will support a Habitat Conservation Plan and application for an Incidental Take Permit, consistent with this Report, for the Covered Activities. Covered Activities shall include ongoing and planned forest management practices as defined within the Oregon Forest Practice Act statutes (Oregon Revised Statutes 527.610 – 527.770, 527.990, and 527.992) and rules (Oregon Administrative Rules Chapter 629). The intent of the Private Forest Accord is to provide coverage for forest practices excluding the application of pesticides or fertilizers. It is anticipated that the HCP application process will further develop the definition of Covered Activities, consistent with the above intent.

1.4.3 Covered Lands Agreement

The Authors will support a Habitat Conservation Plan and application for an Incidental Take Permit, consistent with this Report, for the Covered Lands. Covered Lands shall mean all privately owned forestlands, as defined at ORS 527.620(7), in the State of Oregon.

Nothing in this Report or the legislation implementing it affects:

(a) The treaty or other rights of an Indian Tribe;
(b) The beneficial ownership interest of:

(A) Land held in trust by the United States for an Indian Tribe; or
(B) Land held by an Indian Tribe.

The Board of Forestry shall develop a process for an Indian Tribe to elect to join as an applicant for the Habitat Conservation Plan consistent with the terms and requirements applicable to private forestlands under this Report.

1.4.4 Complete Agreement

This Report, SB 1501, SB 1502, and HB 4055 represent the complete Private Forest Accord agreement of the Authors. Other issues were discussed as part of the Private Forest Accord process for which no agreements were reached. When adopting, amending, or repealing rules as envisioned by this Report, the board shall resolve any gaps or ambiguities in the requirements of this Report -by: (a) referring to the -intent and structure of the rules implementing ORS 527.610 to 527.770 that are in effect on the effective date of SB 1501; and (b) achieving the outcomes described in this Report.

It is the intention of the Authors that any future interpretations of the Private Forest Accord process will look to this Report and the contemporaneous legislation as the complete agreement and will not look to extemporaneous sources.

1.4.5 Additional Issues Considered under the PFA Process

a. Tethered Logging Rulemaking

The Authors agree to initiate rulemaking on tethered logging within three years after the effective date of SB 1501, SB 1502, and HB 4055. This rulemaking may use, but does not need to use, the new adaptive management process described in this Report. The Authors anticipate that the Board of Forestry will evaluate the terms of plans for alternate practices (PFAP) approved for tethered logging practices, including the use of a template PFAP form, and relevant scientific literature to determine whether to promulgate a rule regarding tethered logging practices.

b. Post-Disturbance Rulemaking

The Authors agree that the Board of Forestry should complete a rulemaking under ORS 527.714 related to post-disturbance harvest of trees retained pursuant to the rules adopted pursuant to this Report by November 30, 2025. The new adaptive management process described in this Report will not apply to this rulemaking. Instead, the Authors anticipate that the Board of Forestry will first commission a review of literature and other evidence to consider whether the current rules and practices related to post-disturbance harvest are sufficient to meet the goals of the PFA, and will consider post-fire ecology, post-fire forest regeneration, and worker safety. This process will include stakeholder engagement and solicitation of information from the public and other agencies, through public hearings and/or written comments. ODF will prepare a report that (1) summarizes the literature, comments, and other materials received and (2) evaluates whether current rules need to be modified to align with the goals of the PFA. ODF may choose to include a recommended course of action in its report. The Board will use the ODF report in proceeding under ORS 527.714, including making the findings required by ORS 527.714(5) necessary to adopt a new or revised rule.

1.4.6 Commitments of the Authors

The Authors agree to use all reasonable efforts to support the expeditious implementation of the recommendations contained in this Report. In so doing, the Authors commit to working together in good faith to create a positive, constructive process for achieving the goals of this Report.

The Authors' commitments are subject to (i) the Legislature's adoption of SB 1501, SB 1502, and HB 4055 prior to April 1, 2022; (ii) the Board of Forestry's adoption of permanent rules implementing the recommendations of this Report by November 30, 2022; (iii) the provision of adequate funding for the implementation of the recommendations contained in this Report; and (iv) the receipt of federal assurances relating to the Endangered Species Act by December 31, 2027, for the Covered Species.

1.5 Appendices

The following appendices are attached and incorporated into this Report:

Appendix A – February 2020 Memorandum of Understanding

Appendix B – Delineating Landslide and Debris Flow Susceptibility in Western Oregon in Support of the Private Forest Accord

Appendix C – Guidance for Identification of Slope Retention Areas from Designated Sediment Source Areas

Appendix D – Forest Conservation Credit

CHAPTER 2: RIPARIAN AREAS

2.1 Introduction

Riparian areas provide numerous functions necessary to create and maintain habitat for freshwater species. Thus, prescriptions governing riparian area management are essential to maintain and enhance freshwater habitats in forested landscapes. Strategies that limit human disturbance in riparian areas and provide habitat functions for salmonids and the other covered species are a critical component of this agreement.

In an effort to balance ecological and economic needs, the proposed revised forest practice rules and prescriptions in this chapter differ based on the type of streams associated with unit-level timber harvest. As examples, fish-bearing streams (Type F) and streams inhabited by salmon, steelhead, or bull trout (Type SSBT) receive greater riparian protection than non-fish-bearing (Type N) streams, and many non-fish perennial streams (Type Np) receive greater protections than non-fish seasonal streams (Type Ns). Because of these differences, accurately and fully mapping the hydrography within Oregon's forested watersheds, and correctly identifying the extent and type of streams on the landscape are critical for implementing the revised rules and prescriptions, and to support the application for an HCP. This information will also aid landowners in applying these prescriptions accurately in the field.

2.1.2 Definitions

The Authors intend that definitions under the Oregon Forest Practices Act (ORS 527.610 –527.992) will remain in place consistent with the most current Forest Practice Rules (OAR chapter 629, divisions 600 through 680), except for the following revised or new definitions established in this Chapter:

> **“Channel migration zone”** (CMZ) means the area where the active channel of a stream is prone to move and this results in a potential near-term loss of riparian function and associated habitat adjacent to the stream, except as modified by a permanent levee, dike, railroad lines, or any public transportation infrastructure. For this purpose, near term means the time scale required to grow a mature forest. ODF shall develop a Tech Note to assist in identifying a CMZ consistent with Washington DNR Board Manual 2.
>
> **“Type Np stream”** means all perennial streams that are not Type SSBT, Type F, or Type D streams.
>
> **“Lateral Type Np stream”** means any Type Np stream that is not a Terminal Type Np stream, for the purposes of RMA prescriptions as established in this Chapter in Table 2.
>
> **“Terminal Type Np stream”** means the largest Type Np stream by basin size that is immediately upstream of the end of a Type F or Type SSBT stream, for the purposes of RMA prescriptions as established in this Chapter in Table 2.
>
> **“Type Ns stream”** means all seasonal stream reaches that are not Type SSBT, Type F, Type D, or Type Np streams.
>
> **“Seeps”** means features similar to springs, except without a well-defined point or points of groundwater surface discharge and usually very low flow.
>
> **“Springs”** means features where groundwater discharges to land surface or a surface water body at a well-defined point or points. Spring volumes range from small, intermittent trickles to millions of gallons per day, depending on the groundwater source and hydraulic head.

2.2 Goals

The overarching goal of the riparian management system proposed in this Chapter is to maintain and enhance riparian functions, related specifically to large wood, shade, and sediment, that support fish and amphibians.

2.2.1 Goals Specific to the Proposed Stream Classification System

To aid in implementation and enforcement of the proposed riparian management system, the Authors established the following goals specific to the proposed stream classification system:

a. Develop and maintain statewide hydrography on private forest lands based on the highest-resolution digital elevation models (DEMs) appropriate for such use. Hydrography for stream classification will rely on the synthetic stream layers developed by TerrainWorks derived from high-resolution DEMs in support of the steep-slope management provisions of the Private Forest Accord.

b. Attribute the hydrography with sufficient information to accurately classify streams with respect to fish distribution and habitat and the likelihood of perennial flow.

c. Establish the authority and responsibility for the Oregon Department of Fish and Wildlife (ODFW) to develop and maintain stream layers describing fish use and perenniality.

d. Incorporate the synthetic stream layers, fish habitat and use information, and perenniality classifications into the ODF FERNS system for purposes of implementing the forest practice rules.

e. Ensure that the models, processes, and data used to classify streams with respect to fish use and the likelihood of perennial flow are transparent and accessible to the regulated community and the public.

f. Ensure that the riparian management system is implemented equitably and consistently across the state.

2.3 Private Forest Accord Commitments

2.3.1 Stream Classification

Hydrography for stream classification will rely on the synthetic stream layers developed by TerrainWorks derived from high-resolution DEMs in support of the steep-slope management provisions of the Private Forest Accord. This synthetic stream layer should be updated as new technology or data become available to improve the resolution of the stream network. The Authors agree that the newly- developed layers should be incorporated into the National Hydrography Dataset (NHD).

The following beneficial stream classes are currently identified under OAR 629-635-0200: Type F, Type SSBT, Type D, and Type N. These stream classes are also differentiated by stream size (i.e., small, medium, and large). Under the PFA, the Authors intend that these definitions will persist except for the revised or new definitions established in this Chapter.

2.3.1.1 Determining Distribution of Fish and Fish Habitat

ODFW will maintain a database of data layers mapping fish use utilizing modeling, physical habitat surveys, and fish presence. ODFW will work with ODF to incorporate ODFW's findings into a fish distribution layer for incorporation into ODF FERNS to delineate the Type F stream network.

a. Model and Map

A map will be developed by TerrainWorks to identify Type F streams based on the "Optimal" version of the fish distribution model developed by Fransen et al. 2006[1] by May 1, 2023. As discussed below, end of fish locations identified through valid field surveys will override modeled limits of fish distribution, subject to the review and standards described in subsection (b) below. This map will be incorporated into FERNS no later than July 1, 2023, for purposes of regulating Type- F and Type- SSBT RMAs. After peer review (analogous to that requisite for publication), a fish distribution model being developed by the Pacific Northwest (PNW) Research Station (Penaluna et al., in preparation) will be used to map Type F streams. This will replace the Fransen et al. 2006-derived map in FERNS, provided: 1) the accuracy of the PNW model is deemed by ODFW to be equal to or better than the Fransen (2006) Optimal model, and 2) valid historical field surveys are incorporated as described in 3.3.1.1.b. Other modeled approaches developed in the adaptive management program may be used as well, pursuant to that process.

b. Historical Fish Distribution Field Surveys

The modeled map of Type F streams developed by TerrainWorks will be modified to incorporate historical "ODF End of Fish" information obtained from physical habitat surveys or direct sampling of fish presence, subject to a quality assurance and quality control review where data are available. This review will consider: 1) if surveys were conducted in the seasonal window appropriate for the technique used, and 2) if the survey adequately considered the presence of artificial obstructions.

Data derived from the direct sampling of fish presence will be incorporated into the map of Type F streams unless a review by ODFW concludes that the survey fails to satisfy the following criteria:

1) **Surveys conducted outside of recommended survey season that found an absence of fish based on e-fishing:** Surveys that found an absence of fish based on e-fishing but were conducted outside of the recommended survey season (Table 1 in ODF and ODFW's joint publication, Surveying Forest Streams for Fish Use, 2004) will be

[1] Brian R. Fransen, Steven D. Duke, L. Guy McWethy, Jason K. Walter & Robert E. Bilby. 2006. A Logistic Regression Model for Predicting the Upstream Extent of Fish Occurrence Based on Geographical Information Systems Data, North American Journal of Fisheries Management, 26:4, 960-975, DOI: 10.1577/M04-187.1

disregarded, unless there was a valid scientific reason to use an out-of-season survey (e.g., a waterfall, pH, etc.) approved by ODFW.

2) **Surveys above artificial obstructions conducted prior to implementation of 2007 artificial obstruction rules:** Surveys above artificial obstructions conducted prior to the implementation of the 2007 artificial obstruction rules will not be relied on to determine the end of fish use unless the operator can meet the post-2007 required showing (obstruction will persist until key piece size realized), per OAR 629-635-0200(11)(f). Otherwise, for purposes of layer to be incorporated into ODF FERNS, fish use will be extended above an artificial obstruction to the end of modeled fish use, per OAR 629-635-0200(11)(b).

ODFW must disqualify historic field surveys pursuant to the above no later than May 1, 2023 for purposes of incorporation into the TerrainWorks stream layer and ODF FERNS; provided that should ODFW disqualify a historic field survey after May 1, 2023, the ODF FERNS layer will be updated but units laid out pursuant to the map prior to the update will be considered in compliance.

ODFW will undertake a process of assessing the modeled layer with current ODF end of fish use, prioritizing the streams with the largest deviations between ODF and the model for initial analysis. Where there are large deviations, ODFW will first determine whether it is a product of a pre-2007 artificial obstruction (in which case the model will prevail absent the requisite showing), or due to an otherwise valid survey (in which case the survey would prevail). This process will follow the methodology described in OAR 629-635-0200 (11). If completed in time, ODFW's findings will be folded into the TerrainWorks stream layer that is incorporated into ODF FERNS. Otherwise, ODFW's findings will be incorporated into ODF FERNS as completed.

c. Use of Electro-Fishing (E-Fishing)

Electro-fishing (e-fishing) will remain a valid method of establishing fish absence for FPA regulatory purposes, provided that the protocol will be revised to require surveying 1,320 feet upstream of the last fish located, not the current 150 feet, unless the surveyor first reaches the physical habitat criteria stopping rules described below. All e-fishing surveys are and will be conducted in accordance with NOAA Fisheries electrofishing guidelines and any updates to those guidelines (NOAA 2000). If ODFW convenes a multi-stakeholder process to review efficacy of sampling methods that includes at a minimum equal representation by conservation interests and the timber industry, and following that process adopts a rule that requires the use of methods other than e-fishing to determine fish presence or absence for delineating fish distribution for FPA, then ODF and ODFW will require the use of suitable alternatives. All federally recognized Tribes will be notified by ODFW about this process, including all meetings.

d. Update of Physical Habitat Criteria

e. Table 2, "Physical Habitat Survey to Determine Natural Barriers to Fish Use,"[2] will be updated and elevated into rule by January 1, 2025. The updated physical habitat criteria will rely on peer-reviewed data, and incorporate an external peer review process with scientists who have expertise in stream fish habitat, fluvial processes, and geomorphology; and foresters with field experience surveying for fish presence, with opportunity for public comment. The physical habitat criteria will align with the stopping rules developed through model development and validation in the field in consultation with ODFW.

f. Environmental DNA (eDNA) Surveys

The Authors agree to collaborate and facilitate studies that inform and improve or validate the reliability and efficacy of eDNA on private, state, and federal forestlands, and incorporate those findings into the relevant modeled layers as appropriate.

g. Maintenance of the Fish Use Layer

ODFW-approved survey work will be regularly incorporated into ODF FERNS on a timely basis. ODFW and ODF will create and maintain a clear process for landowner certification of survey work. ODF or ODFW may object to the survey, but absent objection the landowner certification will be accepted and considered final and will be incorporated into the relevant layers. ODFW will also establish requirements for the training and certification of field surveyors.

2.3.1.2 Determining SSBT Habitat Distribution

Changes to the SSBT habitat distribution layer maintained by ODFW were not discussed during the PFA negotiations but are assumed to occur at least every 4 years consistent with OAR 629-635-0200(13)(b).

2.3.1.3 Mapping and Identifying Perennial Streams

a. Identifying Perennial Streams

[2] Oregon Department of Forestry, Forest Practice Rule Guidance: Division 653 Water Protection Rules: Purpose, Goals, Classification, and Riparian Management Areas. 17 December 2021. Available online < https://www.oregon.gov/odf/Documents/workingforests/fpa-guidance-division-635-water-classification.pdf >.

Perennial streams shall be identified based on modeled outputs or field surveys, through a phased approach that is intended to increase mapping resolution as quickly as possible with available information. During the initial phase, existing maps will be used with additional field verification requirements. In the second phase, the perennial stream network will be modeled based on high-resolution LiDAR-derived DEMs, and field verification by the landowner will no longer be required, but will be permitted as described below. The three phases to identify perennial streams are established below:

1) **Phase One: Field identification during harvest unit planning**
   To guide field identification of perenniality, TerrainWorks will incorporate the NHD High Resolution perennial stream classifications in its initial mapped layer. However, landowners will be obligated to apply RMA prescriptions established in this Chapter to perennial streams, whether or not mapped as perennial in ODF FERNS. This phase ends once Phase Two approaches are implemented. Phase One applies statewide.

2) **Phase Two: Comprehensive regulatory layer with potential for field verification**

   a. **West of the Cascade Crest:**

   The USGS in coordination with the PNW Research Station is developing the Western Oregon Flow Permanence Model (Burnett et al., in prep), following an established modeling approach (e.g., Jaeger et al. 2019). The newly developed model relies on high-resolution LiDAR-derived DEMs, various other physical and biological covariates, and field observations on flow permanence collected by a standard method and archived (i.e., FLOwPER; Jaeger et al. 2020). The model returns probabilistic estimates describing flow permanence for the region west of the Cascade Crest. Within three months after the model is available, ODFW in consultation with ODF and the Authors will assess whether or not the model outputs are sufficiently accurate to comprise a regulatory layer, or whether an alternative approach would be better. If sufficiently accurate, then the necessary covariates will be derived and the model will be run for basins in Western Oregon that were not used in model development.

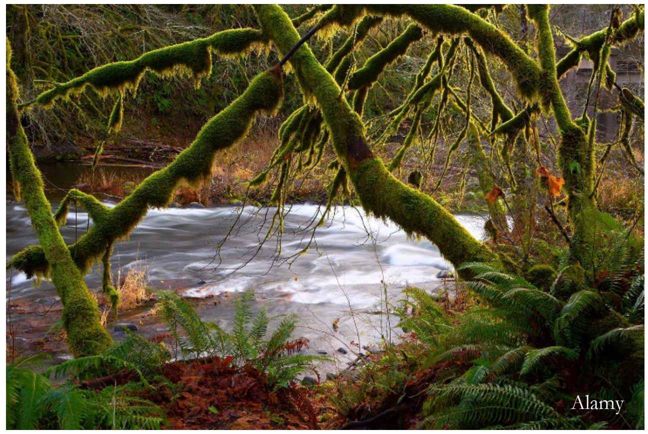
   If ODFW in consultation with ODF and the Authors determines that the model outputs are insufficiently accurate to comprise a regulatory layer, then ODFW in collaboration with the Authors and other stakeholders and state and federal agencies will develop another method to map the extent of the perennial stream network for all private forest lands in Western Oregon. One approach is to develop an index of perenniality. Personnel at the USGS (Roy Sando and Kristin Jaeger) have proposed and can lead development of such an index, which would take advantage of the multiple streamflow permanence datasets that are available for Western Oregon. These include the National Hydrography Dataset streamflow classifications (perennial, intermittent, ephemeral), the USGS PRObability of Streamflow PERmanence Pacific Northwest (PROSPER$_{PNW}$) model outputs, the Western Oregon Streamflow Permanence Model outputs, streamflow permanence field observations used in the calibration of PROSPER$_{PNW}$ (McShane et al. 2017), and recent data collected using the FLOwPER Application (FLOwPER; Jaeger et al. 2020). The datasets differ in spatial resolution (NHD flowlines [with varying spatial resolutions], 30m, 10m, and point), temporal resolution (annual, one-time observations, repeat observations), periods of record (historical and contemporary), degrees of modeling and observational uncertainty, and data formats (i.e., raster, vector). Despite these differences, valuable information can be obtained from each product in determining stream perenniality.

Regardless of the modeled or indexed method chosen, the threshold for flow permanence will be established by ODFW through a joint agency/stakeholder process involving the Authors and the relevant state and federal agencies. The full extent of the perennial stream network for Western Oregon will be reflected in the TerrainWorks synthetic hydrography and become the regulatory layer that is incorporated into ODF FERNS as soon as possible but no later than July 1, 2025. At that time, landowners will be regulated to the new layer. Landowners may request validation by ODFW of fieldwork after presenting evidence that suggests the model outputs are inaccurate for a particular location. ODFW will develop criteria for the submission of evidence such as time-stamped and georeferenced photos. Should a landowner choose to conduct physical surveys, the resulting data conforming with ODFW survey protocols will be used to update the modeled perenniality layer in ODF FERNS.

b. East of the Cascade Crest

Outputs from the USGS PROSPER Pacific Northwest model are currently available for Eastern Oregon. As soon as possible, but no later than July 1, 2024, ODFW will in consultation with the Authors and ODF assess whether or not outputs of the PROSPER model are sufficiently accurate to comprise a regulatory layer. If not, then ODFW in collaboration with the Authors and other stakeholders and state and federal agencies, will develop another method to map the extent of the perennial stream network for all private forest lands in Eastern Oregon. As previously described, an alternative approach could be developing an index of perenniality by combining available data and modeled outputs. Regardless of the modeled or indexed method chosen, the threshold for flow permanence will be established by ODFW through a joint agency/stakeholder process involving the Authors and the relevant state and federal agencies. The full extent of the perennial stream network for Eastern Oregon will be reflected in the TerrainWorks synthetic hydrography and become the regulatory layer that is incorporated into ODF FERNS as soon as possible but no later than July 1, 2025. At that time, landowners will be regulated to the new layer. Landowners may request validation by ODFW of fieldwork after presenting evidence that suggests the model outputs are inaccurate for a particular location. ODFW will develop criteria for the submission of evidence such as time-stamped and georeferenced photos. Should a landowner choose to conduct physical surveys, the resulting data conforming with ODFW survey protocols will be used to update the modeled perenniality layer in ODF FERNS.

3) Phase Three: Adaptive management



The regulatory layers developed in Phase Two will undoubtedly be updated during the 50-year term of the HCP. Updates will be needed to respond to a changing climate as well as advances in understanding and technology. The models and indices described in Phase Two are static and not easily updated as new field observations and other data become available. These problems can be proactively addressed through development of a dynamic operational streamflow permanence model that can provide updated model predictions based on existing and new calibration data and high-resolution stream hydrography. Personnel at the USGS (Roy Sando and Kristin Jaeger) have proposed and could lead a collaborative project to develop a dynamic operational streamflow permanence model. Collaborators would include the Authors, other stakeholders, ODFW, and other relevant state and federal agencies. The modeling structure and statistical methods would likely build on approaches described in Jaeger et al. (2019) and Sando et al. (in prep). Key differences will include: 1) developing the model in a Cloud environment to facilitate recalibrating and re-running the model for specific scales, locations, and time periods; 2) incorporating the ability to preprocess and ingest newly collected (e.g., via FLOwPER) or newly "found" streamflow permanence data; and 3) serving final products through an easy-to-use and customizable interface that allows for visualization of that data (e.g., a dynamic threshold adjustment slider to view how stream perenniality predictions might change given different probabilistic thresholds). Potential timeline for model development and evaluation would be at least 4 years.

If a dynamic, operational model is developed, then the threshold for flow permanence will be established by ODFW through a joint agency/stakeholder process involving the Authors and the relevant state and federal agencies. The full extent of the perennial stream network for the entire state of Oregon will be reflected in the TerrainWorks synthetic hydrography and become the regulatory layer that is incorporated into ODF FERNS. At such time, landowners will be regulated to the new layer. Landowners may request validation by ODFW of fieldwork after presenting evidence that suggests the model outputs are inaccurate for a particular location. ODFW will develop criteria for the submission of evidence such as time-stamped and georeferenced photos. Should a landowner choose to conduct physical surveys, the resulting data conforming with ODFW survey protocols will be used to update the modeled perenniality layer in ODF FERNS.

b. Field Survey and Landowner Information Reporting

All perenniality field surveys will be reported through FLOwPER for incorporation into the Phase Two Modeling as appropriate within 2 months of observation.

2.3.2 Riparian Prescriptions

This section establishes the "**Standard Practice**" for Riparian Management Areas (RMAs) that the Authors have agreed will apply when timber is harvested near streams. Riparian Management Area retains the existing definition under OAR 629-600-0100(63) as "an area along each side of specified waters of the state within which vegetation retention and special management practices are required for the protection of water quality, hydrologic functions, and fish and wildlife habitat." Additional options available to Small Forestland Owners (SFOs) are defined in Chapter 5.

a. Riparian Management Area (RMA) Widths for all Stream Types

All measurements of RMA widths shall be made using slope distance and shall be measured from the edge of the active channel, or channel migration zone (CMZ) if present. The definition of CMZ is established in Section 2.1.2 of this Chapter. The RMA width shall be measured separately on each side of the stream. The RMA width prescriptions established in Table 1 for Western Oregon and Table 2 for Eastern Oregon refer to the width of the RMA on one side of the stream (from the edge of the active channel or channel migration zone (CMZ), if present, upslope).

b. Riparian Management Area (RMA) Lengths for all Stream Types

The measurements of RMA lengths are made from the confluence with the Type F or Type SSBT junction to which they are tributary.

2.3.2.2 Western Oregon Riparian Prescriptions

The table below establishes the RMA widths and prescriptions for Western Oregon under the Standard Practice. The RMA widths in Table 1 refer to the width of the RMA on one side of the stream (from the edge of the active channel or channel migration zone (CMZ), if present, upslope). The RMAs will be laid out as described in Section 2.3.2.4 below.

Table 1. Western Oregon RMAs

Stream Type	RMA Width and Prescription[1]
Large Type F and SSBT	110 feet no harvest
Medium Type F and SSBT	110 feet no harvest
Small Type F and SSBT	100 feet no harvest
Large Type N	75 feet no harvest
Medium Type N	75 feet no harvest
Small Type Np, tributary to SSBT	A 75-foot-wide no-harvest RMA from the confluence with the SSBT stream for the first 500 feet, then a 50-foot-wide no harvest RMA on the next 650 feet, for a total of up to 1,150' (the restricted harvest maximum "**RH Max**" applicable to a Western Oregon Small Type Np, tributary to SSBT), with an R-ELZ and ELZ as defined and further described below
Small Type Np, tributary to Type F	A 75-foot-wide no-harvest RMA from the confluence with the Type F stream for up to the first 600 feet (the "**RH Max**" applicable to a Western Oregon Small Type Np, tributary to a Type F), with an R-ELZ and ELZ as defined and further described below
Type Ns	35 feet equipment limitation zone

[1] All measurements of RMA widths shall be made using slope distance and shall be measured from the edge of the active channel or channel migration zone (CMZ), if present. The RMA width prescriptions established in Table 1 refer to the width of the RMA on one side of the stream (from the edge of the active channel or channel migration zone [CMZ], if present, upslope). Measurements of length are made from the confluence with the Type F or Type SSBT junction they are tributary to.

a. Seeps and Springs in Western Oregon

Seeps and springs within the no-harvest portion of the RMA shall have a no-harvest RMA width of at least 35 feet and the length (parallel to the stream) shall be limited to the length of the feature.

2.3.2.3 Eastern Oregon Riparian Prescriptions

The table below establishes the RMA widths and prescriptions for Eastern Oregon under the Standard Practice. The Eastern Oregon RMA prescriptions establish an inner no-harvest zone and an outer managed-harvest zone. The RMA widths in Table 2 refer to the width of the RMA on one side of the stream (from the edge of the active channel or channel migration zone [CMZ], if present, upslope).

Table 2. Eastern Oregon RMAs

Stream Type	RMA Width and Prescription[1]
Large Type F and SSBT	30 feet inner no-harvest zone and 70 feet outer managed-harvest zone (100 feet total)
Medium Type F and SSBT	30 feet inner no-harvest zone and 70 feet outer managed-harvest zone (100 feet total)
Small Type F and SSBT	30 feet inner no-harvest zone and 45 feet outer managed-harvest zone (75 feet total)
Large Type N	30 feet inner no-harvest zone and 45 feet outer managed-harvest zone (75 feet total)
Medium Type N	30 feet inner no-harvest zone and 45 feet outer managed-harvest zone (75 feet total)
Small Type Np, Terminal	A 30-foot inner no-harvest zone and 30-foot outer managed-harvest zone, for up to the first 500 feet length above junction with Type F or SSBT (the "**RH Max**" applicable to an Eastern Oregon Small Type Np Terminal), with an R-ELZ and ELZ as defined and further described below
Small Type Np, Lateral	A 30-foot inner no-harvest zone for up to the first 250 feet length above junction with Type F or SSBT (the "**RH Max**" applicable to an Eastern Oregon Small Type Np Lateral), with an R-ELZ and ELZ as defined and further described below
Small Type Ns	30 feet equipment limitation zone (ELZ). Within 30-foot ELZ, retain shrubs and trees under 6 inches DBH, where possible, for up to the first 750 feet length from the confluence with Type F or SSBT streams

[1] All measurements of RMA widths shall be made using slope distance and shall be measured from the edge of the active channel or channel migration zone [CMZ], if present. The RMA width prescriptions established in Table 1 refer to the width of the RMA on one side of the stream (from the edge of the active channel or channel migration zone (CMZ), if present, upslope). Measurements

of length are made from the confluence with the Type F or Type SSBT junction they are tributary to.

a. Outer Managed-Harvest Zone Equipment Limitations

All outer managed-harvest zones have an equipment limitation zone of 30 feet from the outer edge of the no-harvest zone.

b. Outer Managed-Harvest Zone Basal Area Retention

All managed-harvest zones will retain at least 60 square feet of basal area per acre. The basal area shall be made up of twenty-seven trees from the largest diameter class per acre with the balance made up of trees greater than 8 inches DBH. Within these retention requirements, species retained will be selected from fire-resilient species such as ponderosa pine, Douglas-fir, Western larch, and available hardwoods where they are present. Retained trees should be evenly distributed where possible based on site conditions.

c. Seeps and Springs in Eastern Oregon

Seeps and springs within the no-harvest portion of the RMA shall have a no-harvest RMA width of at least 35 feet and the length (parallel to the stream) shall be limited to the length of the feature.

2.3.2.4 Small Type Np Layout Methodology

For purposes of this section:

"**Flowing Water**" means continuous visibly flowing surface water within a channel.

A "**Flow Feature**" means Flowing Water for 25' or more.

The "**Modeled End**" means the upper-most point of perenniality on a perennial stream shown in ODF FERNS derived from the ODFW modeling described above, as it may change over time in different phases or as updated by ODFW pursuant to valid field surveys.

The "**Area of Inquiry**" means from the confluence with a Type F or Type SSBT stream to the longer of (a) the Modeled End plus 250', or (b) beyond the Modeled End to the end of the first 250' encountered without a Flow Feature.

The "**RH Max**" means the maximum distance described for any particular Np Stream as defined above.

An "**R-ELZ**" means an equipment limitation zone of 35' in Western Oregon and 30' in Eastern Oregon where all trees less than 6" DBH and shrubs are retained where possible

An "**ELZ**" means an equipment limitation zone of 35' in Western Oregon, and 30' in Eastern Oregon.

For purposes of laying out buffers on Type Np streams, a landowner (or operator) may elect to either lay out the unit relative to the Modeled End or pursuant to a field survey for perennial flow.

If the landowner elects to use the Modeled End without a field survey for perennial flow, then the restricted harvest zone described above will apply from the confluence to the shorter of the RH Max or the Modeled End, an R-ELZ will apply to the distance between the RH Max and the Modeled End, if any, and an ELZ will apply to the remainder of the stream channel.

Alternatively, landowners may elect to lay out Np stream buffers pursuant to a field survey for perennial flow within the Area of Inquiry, and layout must conform with the following rules:

1. If the upper-most Flow Feature within the Area of Inquiry is upstream of the RH Max, then the restricted harvest zone will extend from the confluence to the RH Max and an R-ELZ will extend from that point to that upper-most Flow Feature.
2. If the upper-most Flow Feature within the Area of Inquiry is upstream of the Modeled End but downstream of the RH Max, then the restricted harvest zone will extend from the confluence to that upper-most Flow Feature.
3. If there is no Flow Feature upstream of the Modeled End within the Area of Inquiry, then the restricted harvest zone will extend from the confluence to the shorter of the RH Max or the upper-most Flow Feature within the Area of Inquiry.
4. An R-ELZ will extend from the end of the restricted harvest zone to the last Flow Feature above it within the Area of Inquiry, if any.
5. An ELZ will extend beyond the restricted harvest zone, or R-ELZ if any, to the top of the channel.
6. If the upper-most Flow Feature within the Area of Inquiry is downstream of the RH Max, and Flowing Water that is not a Flow Feature is encountered between the Flow Feature and the RH Max, a 50' restricted harvest zone will be left on the Flowing Water, and the R-ELZ will extend from the upper-most Flow Feature within the Area of Inquiry to the buffered Flowing Water.
7. Where the upper-most Flow Feature is downstream of the RH Max, a no-harvest buffer will extend around the end of the Flow Feature with a radius equal to the no-harvest buffer width at that point.
8. If an Area of Inquiry extends beyond the ownership boundary, and the last 250' before reaching the ownership boundary does not have a Flow Feature, then the restricted harvest zone will extend to the upper-most Flow Feature within the ownership boundary, or the RH Max, whichever is shorter, and an R-ELZ will extend beyond that to the ownership boundary; *provided that* prior surveys documented in ODF FERNS that evidence a Flow Feature upstream of the ownership boundary will alter the layout per the rules above (e.g, if a Flow Feature within the Area of Inquiry but below the RH Max is evidenced in ODF FERNS beyond the ownership boundary, then the restricted harvest zone will extend to the ownership boundary).

In Eastern Oregon, the no-harvest lengths described above would include the inner no-harvest zone and the outer managed-harvest zone consistent with Table 2 of this Chapter.

Prior to Phase 2 modeling described above, during the period that landowners are obligated to buffer perennial streams that are not mapped as perennial, such streams shall have an Area of Inquiry that ends at the RH Max.

The Authors anticipate that the layout methodology will be modified in drought years and abnormally wet years, both of which will be defined by ODFW in a manner that is temporally discrete and relatively exceptional, and confined to the relevant geography. During a drought year, as defined by ODFW, the last Flow Feature within the Area of Inquiry will be deemed the longer of (a) the Modeled End, or (b) the last Flow Feature within the Area of Inquiry (i.e., in a drought year, the buffers can be lengthened but not shortened). During an abnormally wet year, as defined by ODFW, the Area of Inquiry will stop at the Modeled End (i.e., in an abnormally wet year, the buffers can be shortened, but not lengthened).

ODFW will develop a protocol for field surveys of perennial flow for making the determinations above, including for instance, the determination that water is flowing. ODFW will review all field surveys for perennial flow, provided that if ODFW does not object within 21 days, the field survey will control for purposes of unit layout. If ODFW disapproves a survey after the waiting period, the survey will not be incorporated into ODF FERNS, but the landowner may complete the layout and operate pursuant to the survey. If ODFW disapproves a survey during the waiting period, ODFW shall offer an expeditious process for resolving any disagreement with the landowner in conformance with ODFW's protocol for field surveys of perennial flow.

To the degree a landowner intends to conduct a field survey for perennial flow, the landowner must notify ODFW in advance. Such notice may be submitted immediately prior to conducting the survey, but no more than two years in advance. If a landowner provides such notice, then the notification of operation must include either (a) the completed survey, or (b) a certification that the landowner did not initiate the survey.

ODFW will incorporate landowner surveys into its perennial modeling, with weighting for any sample bias, land access limitations, or other problems in data collection, as appropriate. Further, unless disapproved by ODFW, ODF will maintain a record of field survey findings in ODF FERNS, and in completing unit layout landowners may rely on, and must observe, such findings appearing in ODF FERNS.

2.3.3 Slivers of Standing Trees Created by Existing Roads Within the RMA

Where a no-harvest RMA spans an existing road and a stewardship forester determines that the trees on the upstream edge would present a risk of windthrow and a safety hazard to users of the road, the stewardship forester may authorize removal of the trees, provided that an equivalent basal area is retained elsewhere in the harvest unit adjacent to an RMA or Designated Debris Flow Traversal Areas. No slivers greater than 15 feet in width shall be removed.

Miscellaneous

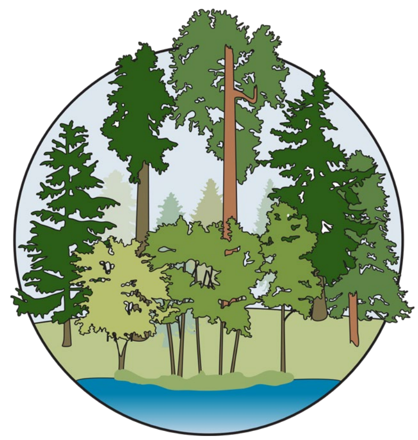
a. Current Rules

The Authors do not anticipate any material changes to the current rules or guidance applicable to management of no-harvest portions of RMAs including the following:

- Roads crossing streams, riparian areas, and equipment limitation zones (to the degree not addressed separately in the roads chapter)
- Cutting yarding corridors through riparian areas, and placement of guy-lines, tail-holds, and other necessary rigging.
- Averaging buffer widths over distances.

b. Wildlife Leave Trees

The Authors expect that, as under current rules, at least some of the trees left in riparian management areas will count toward the wildlife leave tree requirement.



Elizabeth Morales

c. Hardwood Conversion

The Authors expect that the current hardwood conversion option would not be used unless ODF makes a determination that the conversion would substantially improve the likelihood and timeline for reaching "desired future condition," as it may hereafter be defined by the Board.

d. Restoration Treatments

This Report acknowledges the rich and diverse habitat types found on the forests of Oregon, as well as the changes to the character, location, abundance, and ecological function of those habitats due to management over the past century plus. This Report acknowledges that restoration activities that address ecological changes in riparian areas due to alterations in forest disturbance and/or hydrologic regimes, such as removing conifers to ensure diverse hardwood habitats, removing stems in dense riparian areas, reforesting degraded riparian areas, adding large wood to stream channels, reintroducing fire through controlled burning, or high-disturbance treatments that remove invasive species or anthropogenic structures, may be appropriate treatments in some cases. Nothing in this Report is meant to prohibit such activities when genuinely undertaken for ecologically restorative purposes, and the Report Authors recognize that Plans for Alternate Practices are available as a mechanism to advance such projects. To the extent PFAP options and guidelines need expansion and/or revision to clearly accommodate ecological restoration projects, those changes should be made by the department.

2.4 Literature Cited

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CHAPTER 3: TIMBER HARVEST ON STEEP SLOPES

3.1 Introduction

Pacific salmon, bull trout, and amphibians have evolved adaptations to the natural disturbance processes characteristic of watersheds comprising what are now private forest lands in Oregon. Many of these lands are steep and are naturally prone to initiating landslides and debris flows that contribute wood and sediment to drainage networks downslope (Burns et al. 2016; May and Gresswell 2003).

Forest management activities, principally road construction, road maintenance, and timber harvest on steep slopes, can affect the frequency and magnitude of slope failures (Sidle et al., 1985; Swanson and Dyrness, 1975). Roads typically are associated with a large fraction of management-related landslides (Montgomery et al., 1998), and can generate larger landslides than harvest-related failures (Robison et al., 1999). Road-related impacts to aquatic systems are addressed in Chapter 4. This Chapter addresses timber harvest effects on shallow, rapid hillslope failures.

Shallow, rapidly moving hillslope failures, which include undifferentiated colluvial landslides and channelized debris flows, are common in headwater systems (Benda et al., 2005; Hungr, 2014). Such failures initiate from bedrock hollows, convergent headwalls, and other steep slopes, including channel-adjacent features (Highland and Bobrowsky, 2008). Initiation occurs typically within the rooting zone of vegetation (Schmidt et al., 2001) and is associated with high precipitation events over days or weeks (Baum et al., 2011; Smith et al., 2014).

Landslides and debris flows can deliver large volumes of sediment and wood to streams. Landslides most frequently deliver to zero (0) order, 1st order, and 2nd order streams, with 0 order referring to hollows, swales, and headwalls that may not have a defined channel (May and Gresswell, 2004). Most debris flows initiate in headwater channels, rather than in habitat occupied by fish (Benda et al., 2005). However, debris flows can travel long distances, increasing in size as materials scoured along the way are incorporated, before depositing downstream, often in fish-bearing channels. Like many other natural disturbances, landslides and debris flows can adversely impact habitat and kill organisms along their travel paths (Bigelow et al., 2007; Everest and Meehan, 1981; Reeves et al., 1995). However, long term they are important natural processes that are necessary to create and maintain productive habitat for salmonids and other aquatic organisms (e.g., Reeves et al., 1995; Bisson et al., 1997; Gomi et al., 2002; Montgomery et al., 2003; Bisson et al., 2009; Foster et al., 2020).

The sediment and boulders, as well as large wood when available, that are delivered by landslides and debris flows can affect the quality of stream habitats in mountainous areas over time (Bisson et al., 2009). Large wood and boulders help increase physical habitat complexity, store spawning gravels, and regulate transport of fine sediments downstream (Bilby and Bisson 1998; Naiman et al., 2002). Sediment delivered by landslides and associated debris flows can create pools and provide gravel usable for spawning, but such sediment can also adversely impact fish habitat and macroinvertebrates if the frequency and magnitude of inputs are too high or lack large wood (Hartman et al., 1996; Jensen et al., 2009; Kobayashi et al., 2010).

Processes, including timber harvest and fire, can increase the frequency of landslides as well as alter the amount and characteristics of the material delivered to aquatic habitats (Benda et al., 2005; Korte and Shakoor, 2020). Removing trees from shallow-rapid landside source areas and debris flow runout paths via timber harvest decreases the amount of large wood that is available for future transport to fish-bearing streams. Debris flows can carry large wood that is sourced from the initiation site, stored along their length, and standing within their path. Removal of trees can decrease the cohesion of roots available to hold soil on hillslopes with the lowest values of root cohesion in the Oregon Coast Range observed in about the first 5-15 years while understory vegetation and trees re-establish (Schmidt et al., 2001; Jackson and Roering, 2009). The amount of wood and roughness (boulders) in and along a channel influences the distance a debris flow may travel. Lack of larger trees along a debris flow path can increase the debris flow travel distance and the ratio of deposited sediment to wood volumes, which can increase the potential for negative effects and decrease the potential for beneficial impacts in creating and maintaining high-quality aquatic habitat (May 2002; Lancaster et al., 2003; Reid et al., 2016).

Numerous field studies have identified terrain features that foster landslide initiation and determine how far debris flows travel (Benda et al., 2005; Korte and Shakoor, 2020; Robison et al., 1999). Landslides that are most likely to initiate debris flows issue from steep areas of topographic convergence, often called headwalls in Oregon geologic nomenclature (Dietrich and Dunne, 1978). Once a landslide enters a stream channel, a subsequent debris flow will proceed downstream until eventually depositing where the channel gradient becomes too gentle or where a junction angle with a higher-order receiving channel is too large for it to continue (Benda and Cundy, 1990; May and Gresswell, 2004). Models based on this body of field-derived knowledge can predict likely landslide and debris flow behaviors from digital elevation data (Miller and Burnett, 2007; Miller and Burnett, 2008). These models can identify hillslopes most susceptible to timber harvest-associated increases in the frequency of landslides, as well as small, non-fish-bearing stream channels along which leaving large trees is most likely to benefit aquatic habitats (Burnett and Miller, 2007).

Several strategies have been applied in mountainous terrain to reduce and mitigate the effects of forest management on steep slopes and to encourage beneficial outcomes. These include leaving standing and downed trees and other vegetation in areas likely to initiate a landslide or transport a debris flow as a source of large wood for fish-bearing streams; adding wood to debris-flow-prone non-fish-bearing streams; and decreasing the frequency and magnitude of occurrence of human-caused landslides by reducing timber harvest volumes, avoiding potentially unstable slopes, and modifying logging systems to reduce compaction.

The Private Forest Accord seeks to provide the beneficial elements of landslides while mitigating the potential negative effects of forest management activities on shallow, rapid hillslope failures.

3.1.1 Definitions

"Debris Flow" is defined as a rapidly moving slurry of rock, soil, wood, and water, which is most often initiated by a landslide that delivers to and travels through steep, confined stream channels.

"**Debris Flow Traversal Area"** is defined as a non-fish-bearing (Type N) stream that has a non-zero probability of being traversed by a debris flow that delivers to a fish-bearing (Type F or Type SSBT) stream. The probability of traversal is calculated consistent with methods described in "Delineating Landslide and Debris Flow Susceptibility in Western Oregon in Support of the Private Forest Accord" (TerrainWorks 2022), which is attached in Appendix B.

"Designated Debris Flow Traversal Areas" are defined as any Debris Flow Traversal Area that has a probability of traversal in the upper 50%, calculated consistent with the methods described in

TerrainWorks, (2022). The width of the Designated Debris Flow Traversal Area is 25 feet on either side of the Type N stream and the length of the Designated Debris Flow Traversal Area is either:

a. The entire length of the Designated Debris Flow Traversal Area that has a probability of traversal in the upper 20%; or

b. A maximum of 1,000 feet upstream of a Type F or Type SSBT stream confluence for a Designated Debris Flow Traversal Area that has a probability of traversal between 20% and 50% alone or in combination with a Designated Debris Flow Traversal Area that has a probability of traversal in the upper 20%.

"Debris Flow Traversal Area Sub-basins" are defined as catchments within USGS HUC 4th field (8-digit) basins that contain Debris Flow Traversal Areas that have a probability of traversal in the upper 20%.

"Designated Sediment Source Areas" are defined as hillslope areas greater than ¼ acre in size within Debris Flow Traversal Area Sub-basins that provide the top 33% of the landslide-derived sediment to Type F or Type SSBT streams. Designated Sediment Source Areas are identified using methods described in TerrainWorks (2022).

"**Slope Retention Areas**" are defined as the 50%, at a minimum, of Designated Sediment Source Areas in each harvest unit that will be left unharvested.

"**Trigger Sources**" are defined as areas within Designated Sediment Source Areas that have the greatest (top 20%) probability of triggering a high-volume (top 33%) debris flow. Trigger sources are identified using methods described in TerrainWorks (2022).

3.2 Goals


Jim Yuscavitch

The goals of the PFA commitments regarding timber harvest on steep slopes is to provide large wood and sediment consistent with maintaining or improving aquatic habitat within large basins over long timeframes. (For the purposes of this Chapter, large basins are those of a size equivalent to those supporting independent populations of Oregon coastal coho salmon. In modeling to support the PFA, these are USGS HUC 4th Field [8-digit] basins). To accomplish this, sediment sources and debris flow runout paths will be identified and a subset of these will be managed during timber harvest activities to retain trees and other vegetation. These actions, together with other HCP commitments, are intended to provide high-quality habitat to support recovery and long-term conservation of the species covered by this HCP on private forestlands.

3.2.1 Objectives

Aligned with the overall goals for timber harvest on steep slopes to provide high-quality habitat that supports the recovery, protection, and long-term conservation of covered species on private forestlands, the Authors establish the following objectives under the PFA:

a. Leave trees in Designated Debris Flow Traversal Areas to help create and maintain high-quality habitat in:

    1) Type F or Type SSBT streams by delivering large wood and regulating sediment storage and transport.

    2) Type N streams by creating shade and cover for amphibians covered under the HCP.

b. Leave trees in Slope Retention Areas to:

    1) Reduce timber-harvest-related increases in the frequency and volume of sediment delivered to Type F or Type SSBT streams from mass wasting events.

    2) Contribute large wood to Type F or Type SSBT streams.

c. Leave trees on a subset of steep (>70%) slopes immediately adjacent to Type F or Type SSBT streams to:

    1) Stabilize these areas.

    2) Contribute large wood to Type F or Type SSBT streams.

3.3 Private Forest Accord Commitments

3.3.1 Public Safety

No changes are recommended to the existing high landslide hazard location rules for public safety related to timber harvest as these are beyond the scope of the HCP.

3.3.2 FERNS

The locations of Designated Sediment Source Areas and of Designated Debris Flow Traversal Areas will be added to FERNS. Landowners will use FERNS map tools to develop written plans. Notifications will be evaluated by ODF.

3.3.3 Designated Debris Flow Traversal Areas

As defined under Section 3.1.1 of this Chapter, Designated Debris Flow Traversal Areas are a subset of Debris Flow Traversal Areas that have a probability of traversal in the upper 50%, calculated consistent with the methods described in TerrainWorks (2022).

a. Written Plans

Written plans are required for harvest units containing Designated Debris Flow Traversal Areas.

b. Timber Harvest Prescriptions

Timber harvest is prohibited in Designated Debris Flow Traversal Areas. As defined under Section 3.1.1 of this Chapter, the width of the Designated Debris Flow Traversal Area is 25 feet on either side of the Type N stream and the length of the Designated Debris Flow Traversal Area is either:

a. The entire length of the Designated Debris Flow Traversal Area that has a probability of traversal in the upper 20%; or

b. A maximum of 1,000 feet upstream of a Type F or Type SSBT stream confluence for a Designated Debris Flow Traversal Area that has a probability of traversal between 20% and 50% alone or in combination with a Designated Debris Flow Traversal Area that has a probability of traversal in the upper 20%.

Yarding is allowed through Designated Debris Flow Traversal Areas, but the number, size, and location of yarding corridors shall be designed to minimize impacts.

c. Application

The timber harvest prescriptions for steep slopes established under Section 3.3.3 of this Chapter for Designated Debris Flow Traversal Areas apply to any private forest ownership class west of the summit of the Cascade Mountains.

3.3.4 Designated Sediment Source Areas and Slope Retention Areas

As defined under Section 3.1.1 of this Chapter, Debris Flow Traversal Area Sub-basins are catchments that contain Debris Flow Traversal Areas that have a probability of traversal in the upper 20% calculated consistent with the methods described in Benda and Miller (2022). Within the Debris Flow Traversal Area Sub-basins, Designated Sediment Source Areas are hillslope areas greater than ¼ acre in size that provide the top 33% of the landslide-derived sediment to Type F and Type SSBT streams.

a. Written Plans

A written plan is required for any harvest unit containing a Designated Sediment Source Area.

b. Timber Harvest Prescriptions

Timber harvest is prohibited in the Slope Retention Areas. Slope Retention Areas are defined as the 50%, at a minimum, of Designated Sediment Source Areas in each harvest unit that, after office and field review, will be left unharvested.

When choosing Slope Retention Areas, priority shall be given to those that:

1. Contain Trigger Sources; and
2. Are larger.

Adjustments to the distribution and location of Slope Retention Areas are allowed in certain cases. Where safety or increased risks to Type F or Type SSBT streams warrant, landowner representatives may select smaller Designated Sediment Source Areas or those Designated Sediment Source Areas without Trigger Sources instead of the standard priorities. Eligible concerns that may warrant selection of non-priority areas to satisfy the minimum 50% Designated Sediment Source Area requirement are that priority areas would 1) clearly reduce worker safety; or 2) cause more resource impact, such as additional road or landing construction, excessive sidehill yarding, or other yarding practices that clearly increase ecological impacts. Written plans must justify the rationale for choosing non-priority areas to satisfy the minimum 50% Designated Sediment Source Area requirement. Yarding, which may require cutting, but not removal, of trees, is permitted only through Slope Retention Areas that do not contain Trigger Sources, but the number, size, and location of yarding corridors shall be designed to minimize impacts.

c. Application

The timber harvest prescriptions for steep slopes established under Section 3.3.4 of this Chapter for Designated Sediment Source Areas and Slope Retention Areas apply to any private forest ownership class west of the summit of the Cascade Mountains, except for qualifying small forestland owners as identified by Chapter 5 of this Report.

3.3.5 Field Protocols

Field delineation of boundaries for Slope Retention Areas shall be accomplished by landowner representatives who are trained and certified by ODF. Delineation criteria are described in Appendix C. ODF in consultation with the Authors will formalize into a Technical Note the guidance in Appendix C.

3.3.6 Slopes Modeling

The State shall contract to have Designated Debris Flow Traversal Areas, Designated Sediment Source Areas, and Trigger Sources modeled west of the summit of the Cascade Mountains consistent with TerrainWorks (2022). Most of the models described in TerrainWorks (2022) that are used to identify these landscape features have been published in peer-reviewed scientific journals (Miller and Burnett, 2007; Miller and Burnett, 2008; Burnett and Miller, 2007). However, some components of the model to identify Designated Sediment Source Areas based on the probability of sediment delivery to Type F or Type SSBT channels as negotiated are new and have not been peer reviewed. Consequently, the Authors agree that the approach to identify Designated Sediment Source Areas should undergo a scientific review before application. Scientific review will target the scientific merits of the modeling and not the PFA commitments based on the model results. The review will be directed by specific questions posed by the Authors that focus on the modeling methods and underlying assumptions. A key question is the scientific support for using the time-averaged approach in identifying Designated Sediment Source Areas. Unless the review identifies a significant scientific reason to deviate from the time-averaged approach, this will be the basis for modeled outputs to identify Designated Sediment Source Areas. If the review finds significant flaws in the approach or assumptions, then the model will be adjusted, if possible, to address these flaws. If a reconfigured model yields Designated Sediment Source Areas that fail to maintain reasonable consistency with the PFA commitments in balancing the overall number, size, and distribution of Designated Sediment Source Areas with the ecological benefits that the strategy provides, or the model cannot be reconfigured, then the identification of Designated Sediment Source Areas and screening criteria will be adjusted. For clarity, the negotiated terms were based on the mapped outcome of the time-averaged sediment delivery method, not solely the method itself, so maintaining a substantially similar mapped outcome is necessary to meet the PFA commitments. Adjustments to maintain reasonable consistency could include, for instance, a change to the 33% threshold for landslide-derived sediment.

3.3.7 Stream Adjacent Failures

a. Riparian Management Area (RMA) Prescriptions

Riparian Management Area (RMA) prescriptions are established in Chapter 2 of this Report. All measurements of RMA widths shall be made using the slope distance and shall be measured from the edge of the active channel or channel migration zone (CMZ), if present, as defined in Chapter 2 of this Report.

Landowners will extend the Riparian Management Areas (RMAs) established in Chapter 2 of this Report to 170 feet from the edge of a Type F or Type SSBT channel, or to the slope break, defined as at least a 20% difference in slope gradient, whichever is less (Figure 1), for all steep (>70%) slopes immediately adjacent to Type F or Type SSBT streams that are either:

(1) Actively failing and delivering sediment; or

(2) Unstable due to the toe interacting directly with erosive forces of a stream creating slope instability such that a slope failure extending beyond the standard width of the Riparian Management Area, as established in Chapter 2 of this Report, is likely (See Figure 2).

“Actively failing” indicates that erodible material and exposed soils are present and prone to continued shallow-rapid slope instability, with active features such as tension cracks, scarps, ground surface shearing, and oversteepened toes.

The lateral extent (i.e., the width) of the actively failing slope identified under (1) is defined by the edge of the scarp indicating slope movement.

The lateral extent (i.e., the width) of steep slopes identified under (2) should approximate the length (parallel to the stream) of slope instability, which is indicated by stream bank sloughing extending into and beyond the floodplain and into the steep slope.

b. Application

The timber harvest prescriptions for steep slopes established under Section 3.3.7 of this Chapter for Stream Adjacent Failures apply statewide.

3.3.8 Timber Harvest on Steep Slopes in Eastern Oregon

The Private Forest Accord does not prescribe new management measures for landslide initiation zones or debris flow traversal channels in Eastern Oregon. The Authors agree that Eastern Oregon's unique geologies and climates likely mean that these processes are different in magnitude, frequency, and impact on the covered species, when compared to Western Oregon. Similarly, the impact of timber harvesting on these processes is potentially different in Eastern Oregon. In light of this uncertainty, the Authors agree that the Adaptive Management Program shall, beginning no later than January 1, 2024, examine the scientific literature on the impacts that hillslope processes have on the covered species in Eastern Oregon. The primary focus will be on upslope initiated shallow rapid slides and how timber harvesting may impact these in Eastern Oregon environments. A secondary and more limited focus is whether other hillslope processes that likely affect covered species are changed by forest practices. Findings of the Adaptive Management Program on these topics will be presented to the Board of Forestry. These findings should focus primarily on the importance of shallow rapid landslides in Eastern Oregon to habitat for the covered species and the potential modification of these processes by forest practices or lack thereof. The report on this primary topic may or may not include recommendations as to desirability and relative importance of potential management measures. In addition, the report should convey whether the secondary review of literature on the effect of forest practices on other hillslope processes merits more thorough consideration by the Adaptive Management Program in light of scientific literature on the connection of these processes to covered species. Nothing in this Report should be read to suggest that any additional Eastern Oregon steep slope or other hillslope prescriptions are, or are not, necessary. The timber harvest prescriptions for steep slopes established under Section 3.3.3 of this Chapter for Designated Debris Flow Traversal Areas and under Section 3.3.4 of this Chapter for Designated Sediment Source Areas and Slope Retention Areas do not apply to any private forest ownership class east of the summit of the Cascade Mountains. The timber harvest prescriptions for steep slopes established under Section 3.3.7 Stream Adjacent Failures apply to all private forest ownership classes both west and east of the summit of the Cascade Mountains.

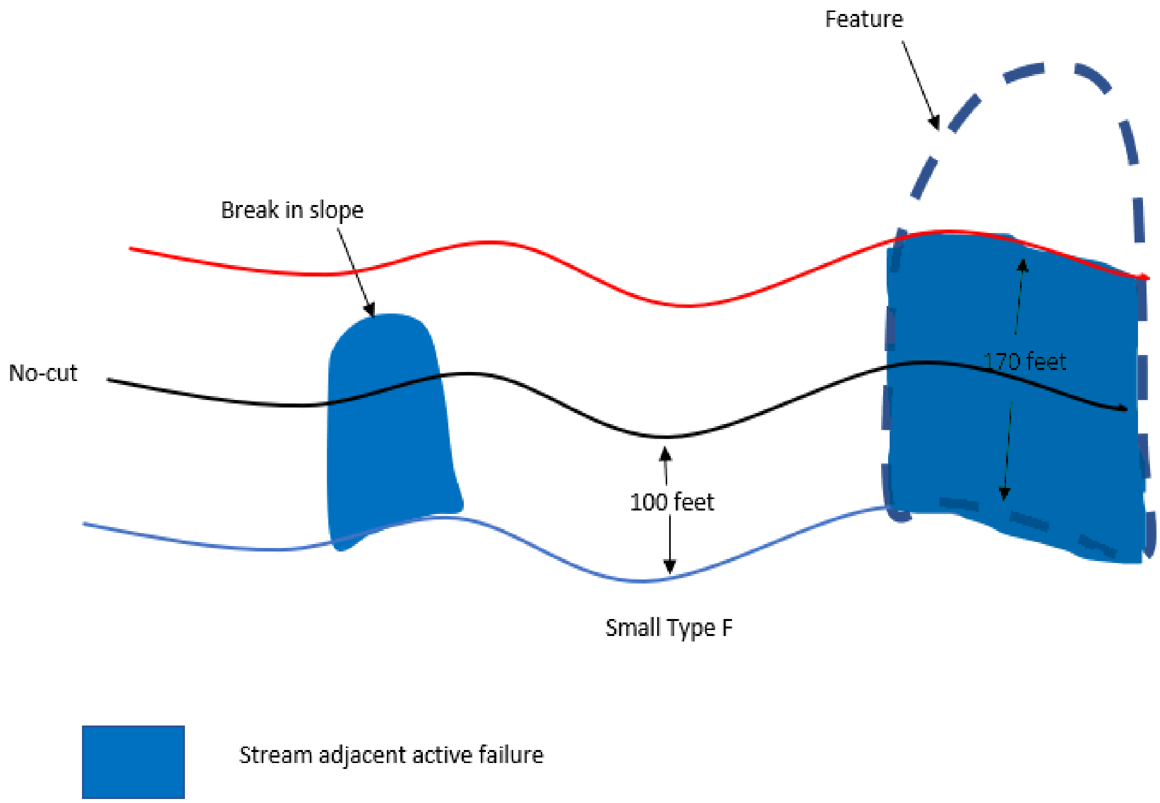
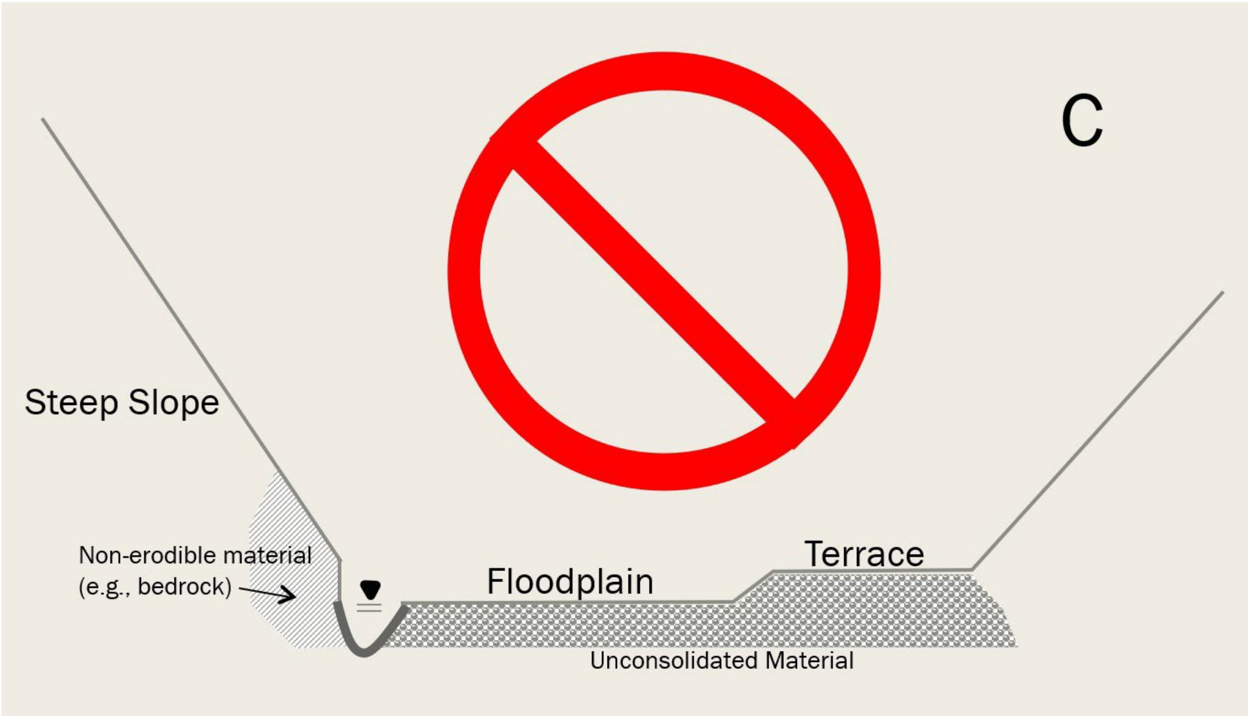
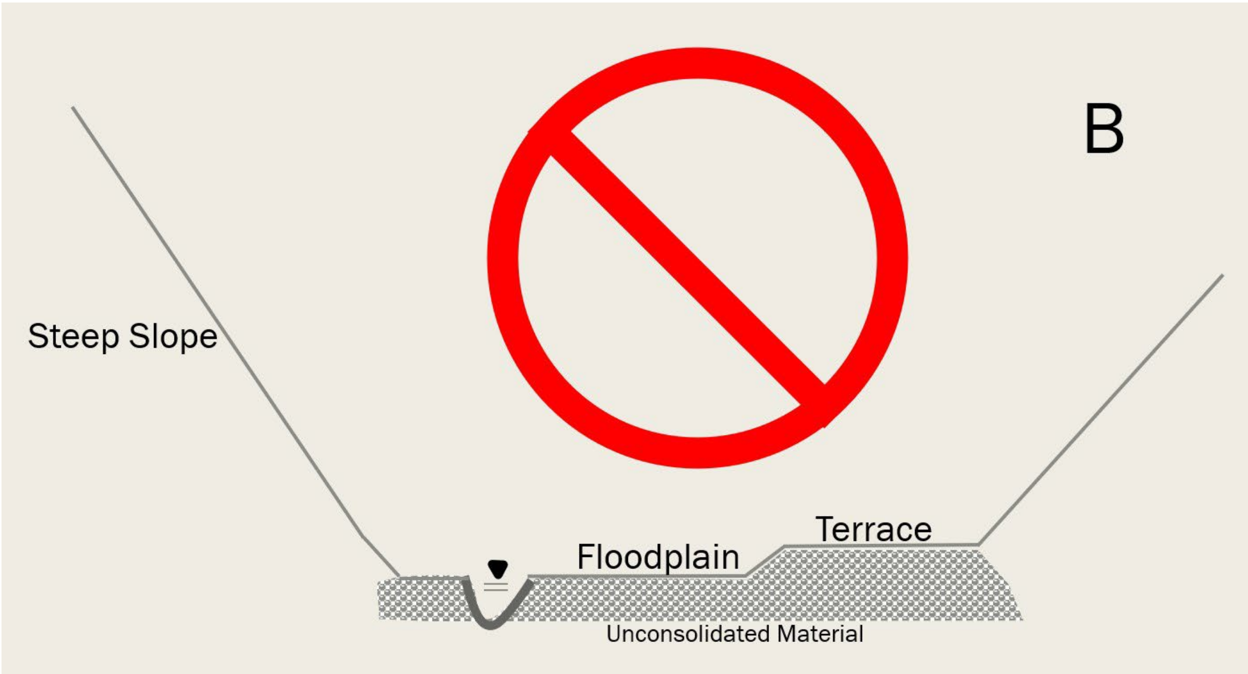
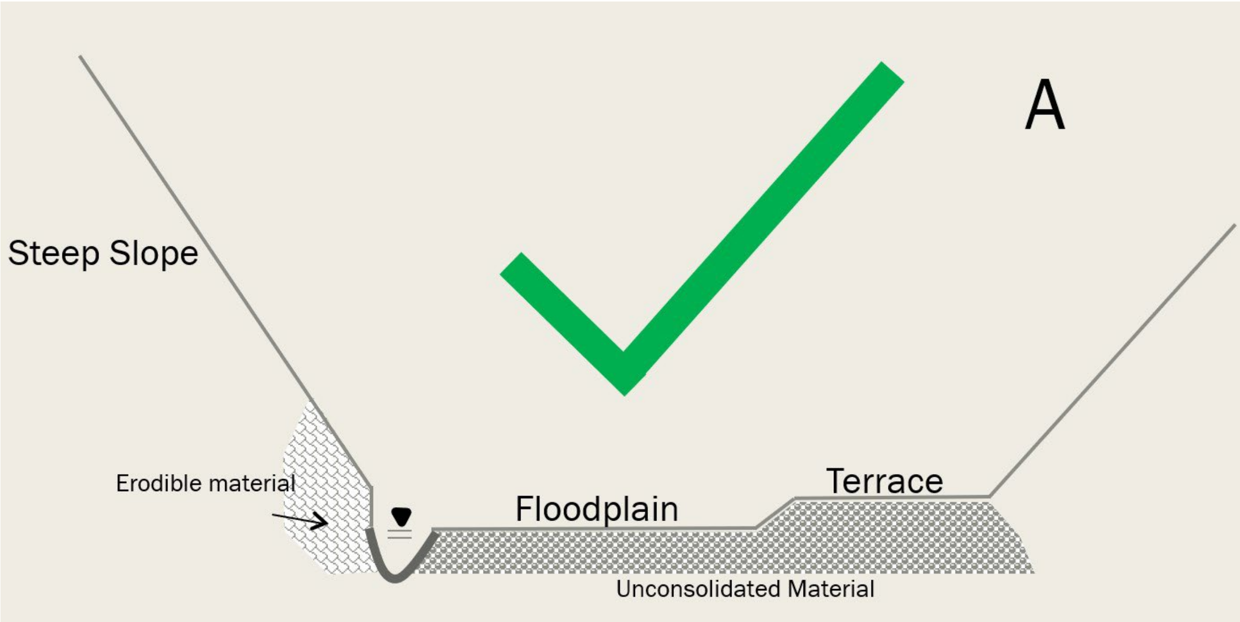


Figure 1. Example drawing of Stream Adjacent Failures relative to limitations imposed on extending the width of Riparian Management Areas on Type F and Type SSBT streams.

Figure 2. Example situations where widening of standard Riparian Management Areas on Type F or Type SSBT streams due to the toe of the slope interacting directly with erosive forces of a stream is or is not warranted (Stream Adjacent Failures). Stream adjacent failure prescriptions apply in C, but they do not apply in A or B.







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CHAPTER 4: ROADS

4.1 Introduction

Forest roads have the potential to impact the covered species by blocking access to habitat and by allowing sediment delivery to watercourses. Networks of forest roads can affect forest hydrology by increasing overland flow, increasing drainage density, and intercepting sub-surface flow (Wemple et al., 2001; Trombulak and Frissell, 2000; Gucinski, 2001; Van Meerveld et al., 2014). Forest roads can increase surface runoff and alter stream flow, although these effects vary in time and space depending on how recently the road has been constructed, where the road is located on the hillslope, and the scale of analysis (Wemple et al., 2001). Networks of forest roads can also act as a source of fine sediment to streams (NCASI, 2001; Reid and Dunne, 1984).

Forest roads can also be an area of potentially high hydrologic connectivity between the road surface and streams (La Marche and Lettenmaier, 2001). Hydrologically connected roads can deliver increased runoff, sediment, and chemicals associated with roads, including spills, tire debris, or oils generated on the road surface or cutslope. At the watershed scale, connections between roads and streams can also alter the drainage density of the watershed and change runoff frequency and magnitude (Furniss et al., 2000; Weaver et al., 2015;Wemple et al., 2001).

The impacts of forest roads on erosional processes are not limited to chronic sources of sediment. Forest roads can lead to accelerated rates of landslides compared to unmanaged forested areas (Ice, 1985; Montgomery, 1994; Swanson and Dyrness, 1975). Roads built on steep slopes, especially using sidecast construction methods, can generate shallow-rapid landslides that often translate into debris flows. Roads can increase stormwater runoff to destabilize downslope hill sides and fill slopes and trigger large sediment pulses, especially when roads are constructed on steep, unstable slopes (Wemple and Jones, 2003). Road-related sediment can fill pools, cover spawning gravel, and aggrade stream channels (Furniss et al., 1991). Collectively, proper placement, construction, and maintenance of forest roads may minimize the frequency and magnitude of mass wasting events, and their associated delivery of sediment to streams.

The changes to Oregon's Forest Practice rules outlined in this chapter provide specific practices to avoid or minimize these impacts as well as systemic changes to the regulatory structure to ensure the practices are applied. It is well established through research that application of the existing and revised rules for forest roads will avoid or minimize the delivery of sediment to waters of the state (Luce and Black, 1999).

4.1.1 Road Location, Design, and Standards

Road location is one of the most important factors that can reduce water quality impacts from roads. Therefore, state recommendations for locating roads include: (1) use existing roads whenever possible; (2) locate roads as far from streams as possible; (3) locate roads to follow the existing slope contours; (4) locate roads on well-drained soils and avoid wetlands, seeps, and other wet areas; (5) avoid steep, unstable slopes to minimize potential for landsliding; (6) minimize excavation; and (7) minimize the number of stream crossings (ODF 2003a, NCASI 2009, NCASI 2012).

4.1.2 Timing of Road Construction and Restricting Use

Road construction can be scheduled to avoid disturbance during wet seasons when increased sediment and delivery are most likely to occur. Controlling the timing of road use can also be used to avoid severe disturbance of forest roads. For example, in the Mediterranean climate of the West Coast, native-surface roads typically are used only in the dry summer period to avoid the types of erosion and sediment loss that would occur with winter use. Furthermore, regulations governing use of roads during wet weather in the western US have become increasingly restrictive to protect water quality (ODF 2003b, Toman and Skaugset, 2011).

4.1.3 Road Surfacing

BMPs for forest roads in erosion-prone areas typically include surfacing with gravel, rock, asphalt, or other suitable materials to provide bearing strength and reduce deterioration and erosion from the road surface, and to achieve durable road drainage configurations. Appropriate surfacing can be combined with compaction to further increase bearing strength and resistance to erosion. For example, Swift (1984) found that 15 cm of crushed rock reduced sediment by 78% compared to a bare road surface. Kochenderfer and Helvey (1987) found an 87% reduction in sediment yield from roads with 15 cm of rock compared to bare soil roads. More recently, Coe (2006) found 16-fold greater median sediment production from unrocked forest roads than from rocked roads in the Sierra Mountains. Unfortunately, even rocked roads can produce sediment during wet weather hauling. In order to reduce sediment production, managers should design road surfaces that resist rut formation and consider the aggregate level of fine sediment (Toman and Skaugset, 2011).

4.1.4 Mulching, Seeding, and Other Road and Stabilizing Techniques

Treatment of bare cut and fill slopes with mulch and seeding are effective BMPs to reduce erosion rates (Bethlahmy and Kidd, 1965; Megahan and Kidd, 1972). Burroughs and King (1989) reviewed studies from around the US where dense grass was used for erosion control of bare soils and found an 86% to 100% reduction in sediment with establishment of dense grass. On native soil roads with light traffic, Swift (1984) found 45% lower sediment yields with grass cover. Furthermore, combinations of seeding, mulching, slash application and water diversion BMPs (i.e., waterbars) provide redundancy and increase the effectiveness of erosion prevention and road stabilization practices (Wear et al., 2013; Wade et al., 2012; Sawyers et al., 2012).

4.1.5 Road Drainage Structures

The spacing of cross drains has been positively correlated with the length of sediment travel along and below roads (Packer, 1967). Therefore, effective spacing of drainage structures is critical, particularly for steeper road gradients with lower topographic position. The closer cross drains are spaced, the lower rill erosion (50% to 97% control reported by Packer) will be for the road surface.

4.1.6 Road Maintenance

Road maintenance is a balancing act between using sufficient treatment to keep the road safe and minimizing berms, rutting, and too much disturbance. As noted by Sugden and Woods (2007) in western Montana, reducing the frequency of grading can significantly reduce sediment yields from roads. Road slope, time since last road grading, roadbed gravel content, and precipitation explained 68% of variability in sediment yields from native surface forest roads.

4.1.7 Disconnecting Roads from Streams

Road drainage structures that deliver runoff directly to streams can affect sediment loads, peak flows, and transport of pollutants to streams. Furniss et al. (2000) showed that hydrologically connected roads can deliver increased runoff, sediment, and chemicals associated with roads, such as spills or oils generated on the road surface or cutslope. Connections between roads and streams can also alter the drainage density of watersheds and change runoff frequency and magnitude (Furniss et al., 2000; Wemple et al., 1996).

Several older surveys documented high rates of road-stream connectivity. For example, in western Washington, Bilby et al. (1989) found that 34% of road drainage structures discharged directly to streams. In the Washington Cascades, Bowling and Lettenmaier (1997) found that 45% of culverts were connected to streams directly and 57% were connected either directly or through a gully.

Application of regulations similar to what is proposed as part of the PFA has demonstrated that these practices are effective in disconnecting roads from streams. For example, Dubé et al. (2010) found just 11% of the road network in Washington state to be hydrologically connected. Martin (2009) reported on a survey of private forest roads covering 1,047 miles of roads in eastern and western Washington. He found that 73% of the road network had low delivery potential (roads located on ridgelines, in shallow terrain, or without crossing defined channels). About half of the road system with high delivery potential was disconnected. Based on that survey, about 12% of the road network was hydrologically connected. Both of these studies were conducted prior to all of the road network being upgraded to the standards required under the Washington Forest Practice Rules.

4.1.8 Limiting Road Use during Wet Periods

Mills et al. (2003) examined turbidity response to wet season road use by monitoring turbidities above and below road crossings. Of sites monitored, 30% showed reductions or no changes to background levels of turbidity, and 90% showed turbidity increases of less than 20 nephlometric turbidity units (NTU). The remaining 10% ranged from 20 to 520 NTU. Total precipitation greater than 1.5–3.0 inches over three days, the fraction of surfacing material that was silt sized or smaller, and more than 250 feet of road ditch flowing directly to the stream were factors that resulted in statistically significant increases in turbidity below road crossings. Findings from this study influenced a subsequent revision to Oregon's Forest Practice Rules.

4.1.9 Fish Passage and Barrier Removal


Brian Kelley

The movement of aquatic organisms is an essential component of their distribution across the landscape and the persistence of populations and species. As life history needs shift, different movements for foraging, reproduction, growth, and refuge are required (Hoffman and Dunham, 2007). Biological corridors and habitat connectivity are critical to the survival and reproduction of covered species (Oregon Dept. of Fish and Wildlife, 2019). Naturally occurring barriers may limit movement of aquatic organisms due to physical constraints, such as channel slope or stream size, limits on food resources, or environmental disturbances (Hoffman and Dunham, 2007). However, barriers placed by humans that restrict or eliminate the movement of aquatic organisms can have multiple impacts, including fragmenting and isolating populations, increasing vulnerability to disturbances, reducing habitat connectivity, and lowering genetic diversity (Hoffman and Dunham, 2007; Hotchkiss and Frei, 2007; Rolls, 2011).

Road crossings in particular can create barriers to fish passage that may result in the loss of habitat for spawning or rearing, isolated genetic populations, inability to access refuge habitats during environmental disturbances, or extirpation (Price et al., 2005; Bates et al.,2003; Beechie et al., 2006; Reiman and Dunham, 2000; Wofford et al., 2005; Neville et al., 2009; Reeves et al., 1995). Barriers to aquatic organism passage related to culverts can include outlet or inlet drops, clogged or collapsed culverts, excessive water velocities and turbulence, loss of bank-edge area, and lack of natural substrate (U.S. Forest Service, 2008). Reducing the impacts of human-placed barriers, such as culverts, requires mitigation of the effects on ecological processes. An ecosystems-based approach to road-stream crossings, such as stream simulation, prioritizes maintaining habitat diversity and quality, the connectivity of watersheds, and key ecological processes (U.S. Forest Service, 2008). Kemp and O'Hanley (2010) state that "evaluation of habitat restoration techniques have shown that the removal or mitigation of barriers that block fish dispersal lead to some of the largest increases in fish production (Roni et al., 2002)." Most recently, fish passage restoration at the watershed-scale has been utilized to increase habitat gain (Oregon Dept. of Fish and Wildlife, 2019).

4.1.10 Steep and Unstable Slopes

Roads in Oregon have been shown to alter landslide and debris flow characteristics, including increasing the likelihood of occurrence, sediment volumes, and runout lengths above those for intact forests or harvested areas (Amaranthus et al., 1985; May, 2002; Miller and Burnett, 2007). A study by Swanson et al. (1977) found that these factors led to sediment production from roads that was 49 times greater than from forested areas in the Oregon Coast Range. In the Oregon Coast Range, Sessions et al. (1987) found landslides associated with both mid-slope and ridge-top roads, but observed fewer landslides with smaller volumes where road layout attempted to minimize mid-slope positions. They noted that the majority of their inventoried landslides were initiated by storms with a return interval of 3 to 5 years and thus by relatively low rainfall amounts typical of such storms.

4.1.11 Definitions

As used in this Chapter:

"Abandoned roads" are defined as roads that were constructed prior to 1972 and do not meet the criteria of active, inactive, or vacated roads. This does not include skid trails.

"Active roads" are defined under OAR 629-600-0100(3) as "roads currently being used or maintained for the purpose of removing commercial forest products."

"Culvert with imminent risk of failure" is defined as a culvert in all waters of the state that:

1) Is actively diverting streams or ditchline runoff;
2) Is actively eroding the road prism or stream channel in a manner that has the potential to undermine the integrity of the culvert;
3) Is completely blocked, plugged, crushed, or buried;
4) Has partially or completely failed fill; or

5) Has high plugging potential as determined by the Stream Blocking Index (SBI)[3] or other comparable methodology, high magnitude of fill at risk, and high diversion potential in one or both directions.

"Culvert with minimal risks to public resources" is defined as a culvert in all waters of the state that:

1) Minimizes delivery of sediment to waters of the state;
2) Has not diverted streams or ditchline runoff and does not have the potential to divert streams or ditchline runoff; and
3) For Type F and Type SSBT streams:
    a. Provides passage for all species of adult and juvenile fish; and
    b. Provides passage of expected bed load and associated large woody material likely to be transported during flood events.

"Hydrologic disconnection" means the removal of direct routes of drainage or overland flow of road runoff to waters of the state.

"Inactive roads" are defined under OAR 629-600-0100(39) as "roads used for forest management purposes exclusive of removing commercial forest products."

"Fully functioning culvert in Type F or Type SSBT streams" is defined as a culvert that is located in a Type F or Type SSBT stream, at the time of Forest Road Inventory and Assessment (FRIA) inspection, meets the requirements of the Forest Practice Rules as of January 1, 2022, and ODF Tech Note 4, Version 1 (effective May 10, 2002).

"Fully functioning culvert in Type N or D streams" is defined as a culvert that is located in a Type N or Type D stream, and that, at the time of FRIA inspection, meets all requirements of the Forest Practice Rules as of January 1, 2022.

"Pre-existing culvert" is defined as a culvert with minimal risks to public resources that is also:

a. A fully functioning culvert in a Type F or Type SSBT stream; or

b. A fully functioning culvert in a Type N or Type D stream.

"Vacated roads" are defined under OAR 629-600-0100(91) as "roads that have been made impassable and are no longer to be used for forest management purposes or commercial forest harvesting activities."

"Waters of the state" has the meaning given in OAR 629-600-0100 (94), *i.e.* "'Waters of the state' include lakes, bays, ponds, impounding reservoirs, springs, wells, rivers, streams, creeks, estuaries,

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[3] Flanagan, S. A., Furniss, M. J., Theisen, S., Love, M., Moore, K., and Ory, J. 1998. Methods for Inventory and Environmental Risk Assessment of Road Drainage Crossings. USDA Forest Service Technology and Development Program 9877-1809-SDTDC. p. 45.

marshes, wetlands, inlets, canals, the Pacific Ocean within the territorial limits of the State of Oregon, and all other bodies of surface or underground waters, natural or artificial, inland or coastal, fresh or salt, public or private (except those private waters which do not combine or effect a junction with natural surface or underground waters), which are wholly or partially within or bordering the state or within its jurisdiction."

4.2 Goals

The overarching goal of the Private Forest Accord road management package is a balanced regulatory approach in which landowners continue to operate all roads as necessary, minimize new road construction, and build and maintain roads to achieve habitat and water quality requirements that ensure the viability of covered species.
To achieve this overarching goal, all roads will be designed, constructed, improved, maintained, or vacated to:

a. Prevent or minimize sediment delivery to waters of the state;
b. Ensure passage for covered aquatic organisms during all mobile life-history stages;
c. Prevent or minimize drainage or unstable sidecast in areas where mass wasting could deliver to public resources or threaten public safety;
d. Prevent or minimize hydrologic alterations of the channel;
e. Prevent or minimize impacts to stream bank stability, existing stream channel, and riparian vegetation;
f. To the maximum extent practicable, hydrologically disconnect forest roads and landings from waters of the state; and
g. Avoid, minimize, and mitigate loss of wetland function.

4.2.1 HCP Goals

The Authors established the following goals for road management under the HCP:

a. Increase distribution of fish on covered lands; and

b. Prevent or minimize delivery of sediment from forest roads to waters of the state.

4.2.2 Objectives of the HCP

In addition to the overarching goal identified for forest roads under the Private Forest Accord process, specific objectives for forest roads as part of the HCP include:

- Removal of anthropogenic barriers to fish passage on active and inactive forest roads;

- Removal or stabilization of unstable road fills on active and inactive forest roads;

- Application of revised rules designed to avoid or minimize delivery of sediment on forest roads and, to the maximum extent practicable, achieve hydrologic disconnection of forest roads and landings from waters of the state; and

- Assessment of and select treatment of abandoned roads.

4.3 Private Forest Accord Commitments

4.3.1 Summary of Inventory Processes for Forest Roads

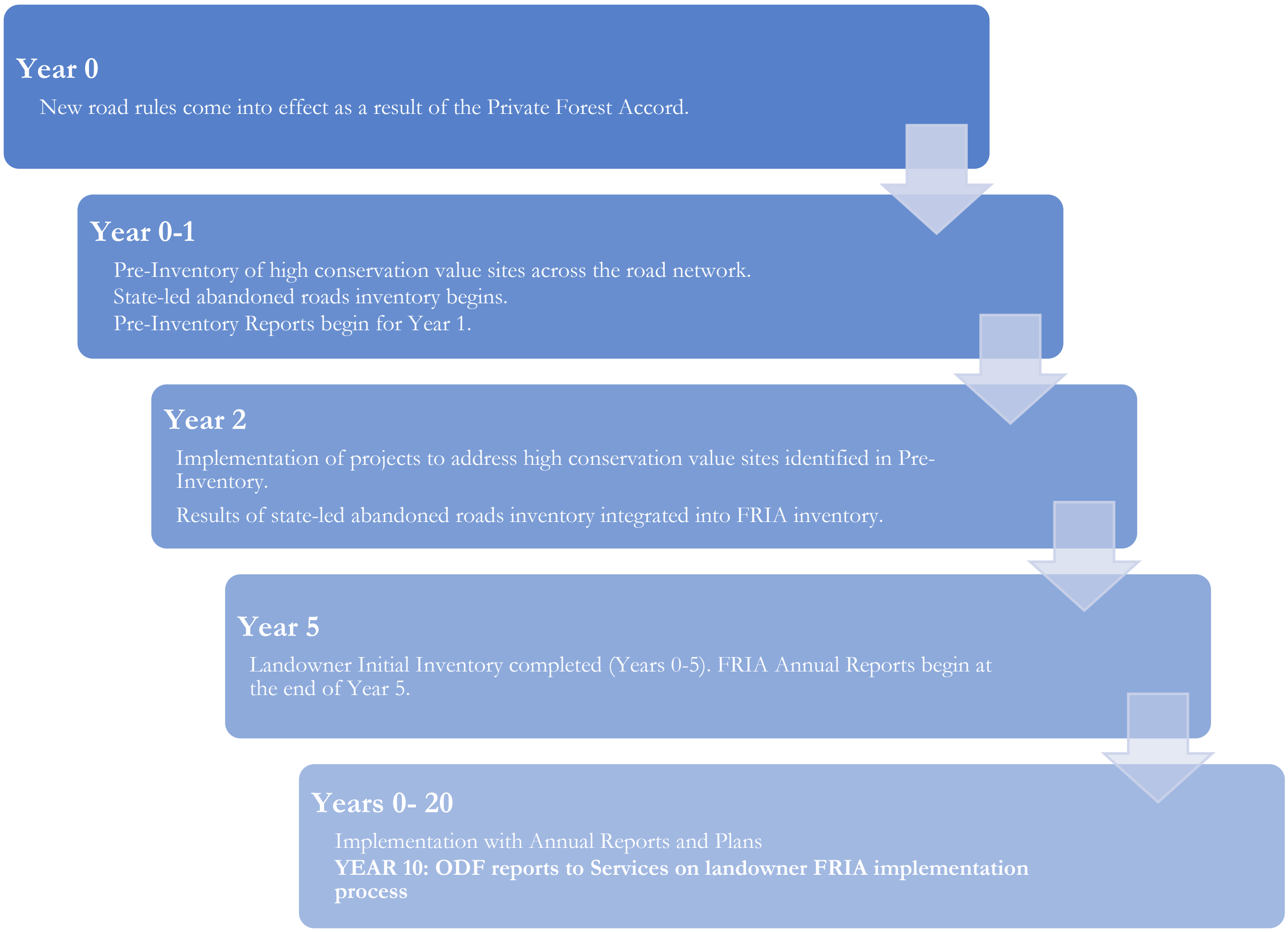
The Authors established several inventory processes to meet the overarching goal of the Private Forest Accord road management package to develop a balanced regulatory approach in which landowners continue to operate all roads as necessary, minimize new road construction, and build and maintain roads to achieve habitat and water quality requirements that ensure the viability of covered species.

In summary, these additions include:

a. Forest Road Inventory and Assessment (FRIA) Process: This establishes an inventory process for landowners to assess the complete road network within their ownership. The goal is to identify whether roads are meeting the Forest Practice Rules (FPRs) that are required to be established under this Chapter and in this Report and bring roads into compliance with the FPRs. It requires identification and implementation of high conservation value projects in the first 1-5 years. By Year 5, landowners must submit an Initial Inventory to Oregon Department of Forestry (ODF) that describes the current status of the road network and a plan to bring roads into compliance with the Forest Practice Rules that are required to be established under this Chapter. The three core documents for the Initial Inventory due by Year 5 are 1) maps, 2) a work matrix, and 3) a written plan. By Year 5 through the culmination of the FRIA process (Years 0-20), landowners must bring roads into compliance with the FPRs that are required to be established under this Chapter and submit Annual Reports and Plans to ODF. ODF will be responsible for managing the data submitted by landowners.

b. State-Led Abandoned Roads Inventory: Under this process, the State of Oregon will take the lead in identifying abandoned roads that are not proactively identified or disclosed by landowners in the FRIA process. First, the State will lead a cooperative effort to identify abandoned roads and assess risk. Then, the State will prioritize abandoned roads for potential remediation. Landowners will then add identified high-priority abandoned road locations into the FRIA process. Landowners will conduct field verification to determine net benefits and practicability of remediation. Finally, if conditions are met, the abandoned road will be remediated as part of the FRIA process.

Figure 1. Timeline of Inventory Processes



4.3.2 The Forest Road Inventory and Assessment (FRIA)

The primary goals of the FRIA process are to determine whether forest roads meet Oregon's Forest Practice Rules that are required to be established under this Chapter, the technical guidance as updated in this Private Forest Accord process and this Chapter, and to bring the forest roads into compliance with the FPRs to the extent necessary.

4.3.2.1 Forest Roads Inventoried under FRIA Process

Roads to be inventoried include Active and Inactive Forest Roads (as defined). Landowners do not need to affirmatively seek out Abandoned Roads, but shall disclose any Abandoned Roads within their ownership of which they are aware. To the extent known, Abandoned Roads and roads vacated pursuant to OAR 629-625-0650 should be included in a FRIA inventory.

There will be four basic road categories tracked within a FRIA:

- Meets FPR standards;
- Does not meet FPR standards;
- Vacated (per OAR 629-625-0650); and
- Abandoned.

Landowners are encouraged to conduct distinct FRIAs for geographically distinct ownership blocks. These blocks shall be called "Road Management Blocks" (RMBs). Separate inventories will be done for distinct RMBs.

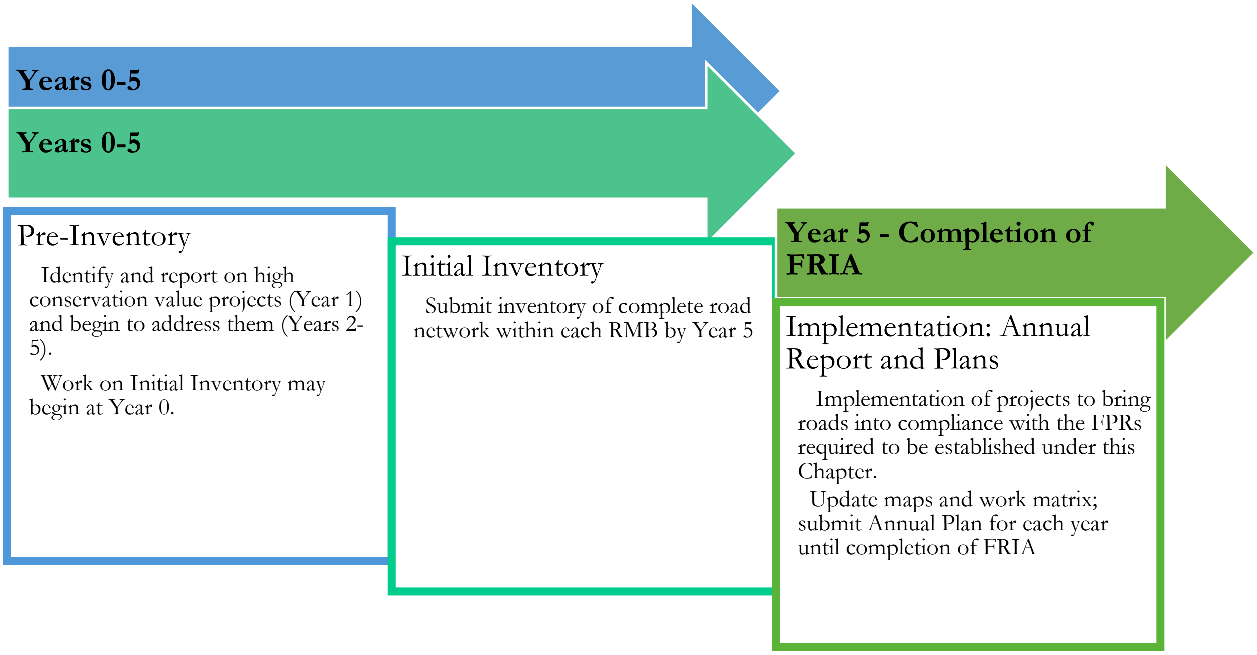
4.3.2.2 The FRIA Process for Each Road Management Block (RMB)

For each RMB, the FRIA process will involve three components:

(1) **A "Pre-Inventory" process** to identify and conduct high conservation value projects from the outset of the FRIA;

(2) **An "Initial Inventory"** where the complete road network inventory must be submitted to ODF within the initial 5-year period; and

(3) **Implementation and "Annual Report and Plan"** that must be submitted to ODF each year starting at the end of Year 5 until the culmination of the FRIA process (Year 20). The Annual Report and Plan tracks the work done and demonstrates progress toward the goal.



a. The Pre-Inventory (Years 0-5)

The purpose of the Pre-Inventory is for landowners to identify, prioritize, and address high conservation value sites within the first five years of the FRIA. In general, high conservation value sites are those sites that currently contribute significant risk to aquatic resources at a scale beyond the site itself and, if resolved, would result in both ameliorating that risk and providing significant ecological benefit at a scale beyond the site itself.

High conservation value sites are defined for the purposes of the Pre-Inventory process as established in this Chapter as sites with:

1) Areas of known chronic sedimentation. Consideration will be given to areas where log hauling will occur during the 5-year inventory phase.
2) Fish passage barriers known to be of significant concern. Priorities will be based on locations where fish passage would provide the greatest benefit to native migratory fish consistent with OAR 635-412-0015(2) and other criteria as determined by the Oregon Department of Fish and Wildlife (ODFW) in consultation with ODF and consistent with the Oregon Fish Passage Barrier Data Standard developed by the ODFW Fish Screening and Passage Program.
3) Ongoing stream diversions at stream crossings and areas with stream diversion potential;
4) Areas of known hydrologic connectivity.

In the Pre-Inventory process, landowners will prioritize high conservation value site projects to ensure compliance with the Forest Practice Rules that are required to be established under this Chapter that:

1) Remove fish passage barriers consistent with ODFW requirements;
2) Minimize the potential for sediment delivery to waters of the state;
3) Minimize stream diversions at water crossings;
4) Minimize hydrologic connectivity between roads and waters of the state; and that
5) Meet other relevant criteria as determined by ODF in consultation with other state and federal agencies.

After landowners submit their Pre-Inventory list of sites in Year 1, ODF and ODFW will meet with each landowner in Year 2 to review the list. ODF and ODFW will coordinate to ensure that high conservation value site projects are prioritized based on habitat values, road conditions, sediment delivery to waters of the state, hydrologic connectivity, and fish passage in alignment with the barrier assessment and inventory prioritization under the ODFW Fish Passage Program (FPP). Additionally, ODF and ODFW will coordinate to ensure that information collected in the Pre-Inventory process is standardized and is in a format consistent with the Oregon Fish Passage Barrier Data Standard (OFPBDS) and this Chapter.

Year 0-1: Within the first year of the Pre-Inventory, landowners prepare a list of high conservation value sites as defined above. This list is based on the landowner's evaluation of 1) areas of known chronic sedimentation; 2) fish passage barriers known to be of significant concern; 3) ongoing stream diversions at stream crossings and areas with stream diversion potential; and 4) areas of known hydrologic connectivity. The landowner submits a report at end of Year 1.

Year 2: Landowner meets with ODF and ODFW to discuss the Year 1 list and to solicit feedback on the prioritization of the Pre-Inventory. ODF and ODFW can propose additional projects to a landowner's Pre-Inventory list if they believe that a high conservation value site has not been addressed.

Landowners that do not identify any high conservation value sites in the Pre-Inventory are still required to meet with ODF and ODFW to solicit feedback on the process.

Years 2-5: Landowners will begin to address projects following Year 2 meeting with ODF and ODFW. Landowners will submit annual reports to ODF for Years 2-5 to confirm that Pre-Inventory projects are being addressed and to provide status updates.

b. The Initial Inventory (Years 0-5)

The Initial Inventory occurs concurrently with the Pre-Inventory during the first five years of the FRIA process. As part of the Initial Inventory, an assessment of the complete road network for each RMB must be submitted to ODF within the initial 5-year period of the FRIA.

In the Initial Inventory, landowners will identify and prioritize sites consistent with the following priorities for work over the FRIA period. Priorities for work will be projects that will provide the greatest environmental benefit (greatest good first), consistent with potential risk of negative impacts to resources protected under the FPA. Generally, projects will be prioritized in the following order, while also taking into consideration operational constraints:

1) Fish passage barriers, consistent with ODFW requirements.
2) Erosion and sediment within the road prism (cutslope, ditch, road surface, fill slope), stream diversion potential, and hydrologic connectivity such that delivery to waters of the state is minimized.
3) Potential slope failures which could deliver to waters of the state.
4) Basins containing, or road systems potentially affecting, waters which either contain a listed threatened or endangered aquatic species under the federal or state law or a water body listed on the current 303(d) water quality impaired list for road-related issues.

ODF and ODFW will coordinate to ensure that information collected in the Initial Inventory is standardized and is in a format consistent with the Oregon Fish Passage Barrier Data Standard (OFPBDS) and this chapter. Landowners will prioritize addressing the high conservation value site projects identified in the Pre-Inventory in consultation with ODF and ODFW.

Years 0-5: Landowners will assess the complete road network within each RMB to develop the core documents required for the Initial Inventory submission (maps, work matrix, and written plan).

Year 5: Before the close of Year 5, landowners will submit the Initial Inventory to ODF. ODF will coordinate with ODFW to ensure that data submitted through the Initial Inventory is consistent with ODFW data standards, specifically for the Oregon Fish Passage Barrier Data Standard (OFPBDS) and this Chapter.

The Initial Inventory Submission will include three core documents:

(1) **Maps:** Paper or electronic maps showing an RMB's road network. ODF will provide guidance on how to best share data.

(2) **Work Matrix:** A document or table showing actions necessary to ensure that all roads are brought into compliance with the FPRs that are required to be established under this Chapter. This document will also show prioritization of work.

(3) **Plan:** A written plan describing how the landowner intends to bring its road network into compliance by the close of the FRIA period (Years 0-20). Shall include specific actions likely to be addressed in upcoming calendar year, and also a general description of how all work will occur during the FRIA period. The plan shall include a description of how the

landowner is prioritizing the work, with the goal of optimizing the environmental benefits of projects and ongoing operations.

The specific information included in the Initial Inventory Submission shall include:

- **Location and Length of Forest Roads:** Inventories will show the location and estimated length of Active roads, Inactive roads, and Vacated roads in an RMB.

- **Locations of Streams:** To the extent known, an inventory will show the location of streams in an RMB. Streams shall be coded as Fish, Non-fish, SSBT, fish presence unknown, and/or 303(d) listed due to sedimentation, turbidity, or temperature to assist in the prioritization of work.

- **Status of Road:** Each road segment in an inventory shall be identified as meeting FPR standards, not meeting FPR standards, Vacated, or Abandoned. This will include a determination of whether a road segment is complying with FPRs that are designed to hydrologically disconnect roads. Where a road is determined to not comply with FPRs, the landowner will identify the work necessary to achieve standards and prioritize the work accordingly (e.g., replace a culvert, disconnect a crossing, etc.). Detailed design plans will be submitted in the Annual Report and Plans.

- **Abandoned Roads:** Abandoned roads known by the landowner should be disclosed in the FRIA. Unknown abandoned roads will be addressed through the State's inventory process and integrated into the FRIA as described in that process.

- **Road-Related Fish Passage Barriers:** Each known or potential road-related fish passage barrier should be identified and prioritized. The prioritization of road-related fish passage barriers shall be described in the Initial Inventory with the goal of optimizing environmental benefits of projects and ongoing operations. ODF will coordinate with ODFW to ensure that assessment and prioritization of fish passage barriers is consistent with the ODFW Fish Passage Program and that any data collected is consistent with the Oregon Fish Passage Barrier Data Standard (OFPBDS) and this Chapter.

- **Locations of Stream Crossing Culverts:** The inventory shall show the location of stream crossing culverts in an RMB.

- **Status of Stream Crossing Culverts:** The inventory shall show the status of stream crossing culverts in an RMB. An assessment of the status of a stream crossing culvert shall include:

    - Date of installation, if known;

    - Assessment of the culvert material used;

    - Assessment of whether the culvert is:

        - A fully functioning culvert in a Type F or Type SSBT stream;

    - A fully functioning culvert in a Type N or Type D stream;
    - A culvert with imminent risk of failure;
    - A culvert with minimum risks to public resources; or
    - Of a status that cannot be determined. If the status of the culvert cannot be determined, it must be included and prioritized for improvement during the course of the FRIA. The status may be changed as more detailed information is gathered as part of the annual work plan and inventory update process.

c. Annual Inventory Reports and Plans (Years 5–20)

After the Initial Inventory is submitted to ODF, landowners shall submit an Annual Inventory Report each year until the completion of the FRIA process (Years 0-20).

<u>The Annual Inventory Reports and Plans will include three core documents</u>:

- **Updated Maps:** Mapping similar to Initial Inventory submission but updated to reflect work done over course of the prior year, additional information discovered, and potential changes in prioritization.
- **Updated Work Matrix:** Updated table or document corresponding to inventory submission showing work completed and work to be completed. This may show changes in prioritization and discovery of new issues.
- **Annual Plan:** Updated plan discussing 1) work conducted in prior year, 2) work likely to be completed in upcoming calendar year, and 3) general plan to complete all necessary work by the end of the FRIA period.

Collectively, the Annual Plans, Updated Work Matrixes, and Updated Maps for each RMB must show and contain:

- **Total Length of Forest Roads Improved:** Both in annual period, and over course of FRIA process.
- **Total Length of Forest Roads Still Requiring Improvement:** Remaining miles of road requiring improvement.
- **Total Length of Forest Roads Planned for Improvement in Upcoming Year:** Plan to detail location and nature of the work.
- **Total Length of Forest Roads Vacated:** Both in annual period, and over course of FRIA process.
- **Total Length of Forest Roads Planned to be Vacated in the Upcoming Year:** Plan to detail location and nature of work.

- **Number of Fish Barriers Brought into Compliance with the FPRs that are Required to be Established under this Chapter:** Both in annual period, and over course of FRIA process.

- **Number of Fish Barriers Still Needing Improvement:** Both in annual period, and over course of FRIA process.

- **Number of Fish Barriers to be Improved in the Upcoming Year:** Plan to detail location and nature of work.

- **Certification that Landowner Remains on Track to Complete FRIA Process:** Landowner to certify, after review of inventory, work history, and plans that they believe they will meet FRIA completion deadline. Failure to certify requires landowner to seek immediate extension from ODF.

4.3.2.3 Pre-Existing Culverts Identified in FRIA Process

Pre-existing culverts require a separate category and treatment under FRIA if these culverts are fully functioning with minimal risks to public resources and therefore are a lower priority to bring into full compliance with the FPRs that are required to be established under this Chapter. Culverts that are not fully functioning may be impassable to fish, restrict fish movement, result in loss or degradation of habitat, have diversion potential or high hydrologic connectivity, or otherwise represent a risk to public resources. See definitions under Section 5.1.10.

a. **Pre-Existing Culvert Determination under FRIA:**

Once a landowner has inventoried and assessed the status of a stream crossing culvert as part of the Initial Inventory, the landowner shall address each pre-existing culvert and each culvert that does not meet the definition of a pre-existing culvert pursuant to the following requirements:

i. If the structure is fully functioning with minimal risk to public resources and the date of installation is known, it shall be maintained until the end of its service life. In any case where a culvert has been reused and the first installation date is known, it shall be maintained until the end of its service life from the original date of installation.

ii. If the structure is fully functioning with minimal risk to public resources and the date of installation is NOT known, the culvert must be inspected at least every five years as part of the Annual Inventory Report and Plans process under the FRIA.

iii. If the structure is NOT fully functioning, or there is more than a minimal risk to public resources (e.g., fish passage barrier or high diversion potential), it needs to be prioritized to be repaired or replaced as part of the FRIA process. These culverts will not be considered "pre-existing culverts."

iv. If the structure has an imminent risk of failure, it needs to be repaired or replaced as soon as practicable, but no later than two years after the structure is identified.

Repair or upgrades can include, but shall not be limited to, measures such as adding a Metal End Section (MES) at the inlet to increase capacity and debris-passing performance. If structural failure occurs, the landowner or manager must, within 90 days, submit to ODF for review and approval a plan or plans for that culvert to be repaired or replaced as soon as practicable. These culverts will not be considered "pre-existing culverts."

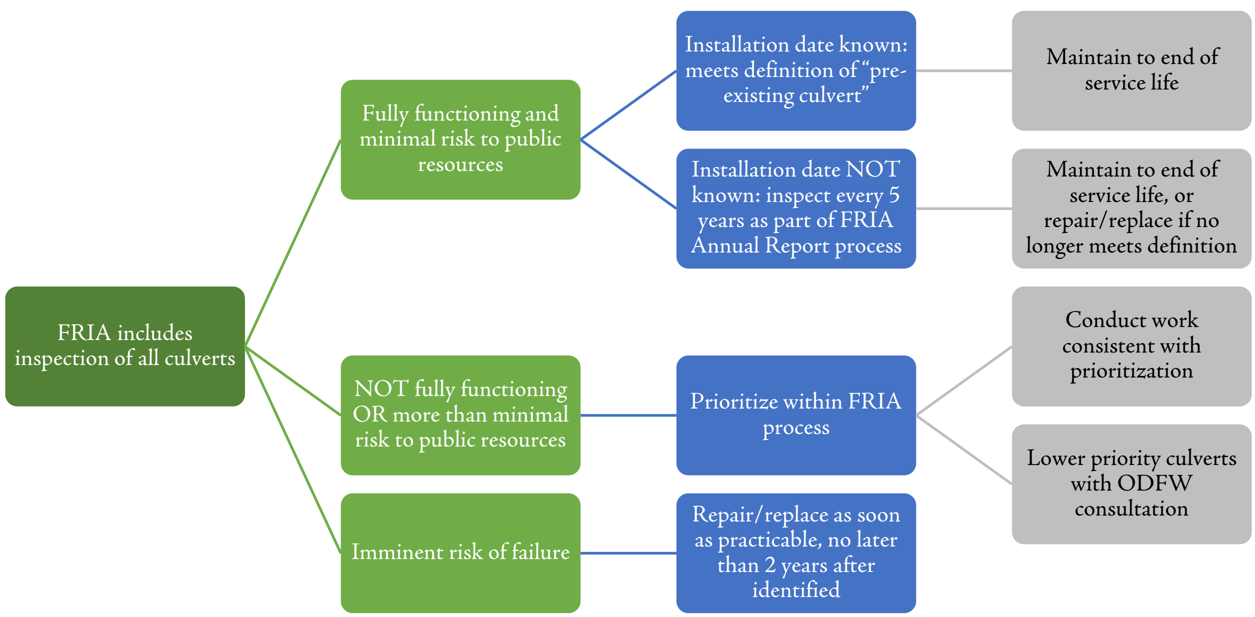
b. Lower Priority Culverts that Do Not Meet the Pre-Existing Culvert Definition

Lower priority culverts, in consultation with ODFW, may be maintained until the end of their service life, or a maximum of 30 years:

(i) If, in consultation with ODFW, the culvert is partially functioning to provide fish passage and the cost of repair/replacement is disproportionate to the benefits of repair/replacement; or

(ii) If, in consultation with ODFW, the culvert is providing valuable wetland or pond habitat.

Figure 2. Framework to Address Pre-Existing Culverts in the FRIA Process



4.3.3 Small Forestland Owners (SFOs) and Road Management

The Authors do not intend for the FRIA process to apply to small forestland owners (SFOs), but small forestland owners (SFOs) will be required to submit Road Condition Assessments (RCAs) under various circumstances, as established under Chapter 5. All new construction related to roads on forestland owned by SFOs must satisfy the same standards of the Forest Practice Rules that apply to all landowners that are required to be established under Chapter 5.

4.3.4 State-Led Abandoned Roads Inventory

Abandoned roads are defined as roads that were constructed prior to 1972 and do not meet the criteria of active, inactive, or vacated roads. This does not include skid trails. Many abandoned roads are unmapped and may be difficult to inventory. Abandoned roads present special risks to aquatic systems, as lack of regular access can result in ongoing and potential problems going unnoticed. Some of these abandoned roads have the potential to produce chronic sediment and increase risks of mass wasting and stream diversions. Gucinski et al. state that "Plugged culverts and fill-slope failures are frequent and often lead to catastrophic increases in stream channel sediment, especially on abandoned or unmaintained roads (Weaver and others, 1995)" (Gucinski et al., 2001, p. 28).

Stream diversion and diversion potential at stream crossings are critical concerns for abandoned roads. Diversion potential for a stream exists when crossing capacity may not accommodate high flows, causing the stream to back up behind the fill and flow down the road. If the stream crossing capacity is exceeded and the stream simply flows over the road fill and back into the natural channel, the stream crossing does not have diversion potential. Stream diversion may also occur due to ice and snow accumulations on the road or if debris flows deposit material across the roadway (Furniss et al., 1997, p. 1). Furniss et al. (1997) note that "In almost all cases, diversion will create a greater erosional consequence of capacity exceedance than streamflows that breach the fill but remain in the channel" (p. 1).

The number and condition of abandoned roads on private timberlands in Oregon is uncertain, but abandoned or "legacy" roads have been cited by the Environmental Protection Agency and NOAA Fisheries as an area of concern and a reason for the agencies' disapproval of Oregon's coastal nonpoint pollution control program.

4.3.4.1 Process to Address Abandoned Roads through State-Led Inventory

To address the risks that abandoned roads may pose to waters of the state, the following process will be implemented. This process would prioritize assessments of abandoned roads and require remediation if needed based on risk to aquatic systems and cost to remedy.

Figure 3. Summary of State-Led Abandoned Roads Inventory Process

- **Step 1** — State leads a cooperative effort to identify abandoned roads and assess risk.
- **Step 2** — State prioritizes abandoned roads for possible remediation.
- **Step 3** — Landowners add high-priority abandoned roads to the FRIA process.
- **Step 4** — Field verification will determine the net benefits and practicability of remediation.
- **Step 5** — If conditions are met, abandoned road is remediated in FRIA process.

<u>Step 1) The State, in coordination with EPA, leads a cooperative effort to identify abandoned roads and assess risks.</u>

ODF will identify abandoned roads through the use of LiDAR object-based classification (e.g., the methods described in Sherba et al., 2014), supplemented by existing GIS data, aerial images, landowner disclosure of known abandoned roads, inventory data, and some site visits for calibration. DEQ and U.S. EPA will provide consulting and technical support for ODF implementation.

After identifying abandoned roads, the state and cooperators would then identify locations associated with abandoned roads with a high level of risk to waters of the state or infrastructure.

<u>Criteria to determine high-risk locations, in order of preference, should include:</u>

1. Ongoing stream diversions at stream crossings;
2. Diversion potential at stream crossings;
3. Likelihood of hydrologic connectivity;
4. Comparative risk of chronic sediment produced; and
5. Risk of contribution to mass wasting.
6. Other relevant criteria as determined by ODF in consultation with other state and federal agencies.

Additional criteria to determine high-risk locations should consider abandoned roads located in the critical locations under the FPRs that are required to be established under this Chapter.

The result of this process will yield a set of potential high-risk locations for further consideration for remediation.

Step 2) State prioritizes abandoned roads for possible remediation.

Following the identification of abandoned roads and ranking of risk, the State will work with landowners to develop priorities for potential remediation in a stakeholder process to determine high priorities.

Considerations should include:

1. Importance of the watershed (HUC-6) to recovering salmonids;
2. Number of stream crossings based on full-densified stream network in GIS or LiDAR;
3. Cost and benefit of work to remediate problems and risks; and
4. Other relevant criteria as determined by ODF in consultation with other state and federal agencies developed in the stakeholder process.

The result of this process will yield a set of high-priority abandoned road locations from the identified high-risk locations in Step 1.

Step 3) Landowners add high-priority locations to the Forest Roads Inventory and Assessment (FRIA).

Where high priority abandoned road locations are identified under Step 2, landowners shall add them to the Initial Inventory (Years 0-5) of the FRIA process.

Step 4) Field verification will determine the net benefits and practicability of remediation.

Field verification of all high-priority sites will be documented through the FRIA annual implementation reporting process. ODF, in consultation with the Oregon Department of Environmental Quality and Oregon Department of Fish and Wildlife when necessary, will review landowner verifications of high priority sites and remediation plans as part of the annual work plan process.

Field verification shall include:

1. **Confirmation that the high-priority location is on an abandoned road.**

2. **Determination regarding whether the high-priority location is diverting the stream or has diversion potential.**

   a. The State and cooperators will develop indicators to determine whether the location is actively diverting the stream or has diversion potential (*See* Furniss et al., 1997).

   b. Landowners should consider potential erosional consequences, the value of downstream resources, the sensitivity of downstream resources to erosion and sedimentation, and costs to repair the road if a stream diversion occurs.

3. **Determination regarding whether the high-priority location is actively contributing sediment or has a high risk of contributing significant quantities of sediment to waters of the state.**

   a. The state and cooperators will develop indicators to determine whether the location is actively contributing or has the potential to contribute sediment to waters of the state. These indicators could include:

      - A sediment deposit that reaches the high water line of a defined channel of flood-prone area.
      - A channel that extends from a road drainage structure outlet to the high water line of a defined channel or a flood-prone area.
      - Evidence of surface flow between the drainage structure outlet and a defined channel or a flood-prone area.
      - Observation of turbid water reaching all typed waters, lakes, bays, ponds, impounding reservoirs, springs, rivers, streams, creeks, estuaries, marshes, wetlands, inlets, and canals during runoff events.
      - Evidence of direct sediment entry into a watercourse or a flood-prone area from road surfaces or drainage structures and facilities (e.g., ponded sediment, sediment deposits, delivery of turbid runoff from drainage structures during rainfall events);
      - Gullies or other evidence of erosion on road surfaces or below the outlets of road drainage facilities or structures, including ditch drain (relief) culverts, with transport or a high likelihood of transport to a watercourse.
      - Native-surfaced road exhibiting erosion.
      - Native-surfaced road composed of erodible soil types (e.g., granitic soils).
      - Rilled, gullied, or rutted road approaches to crossings.
      - Existing ditch drain (relief) culverts or other road drainage structures with decreased capacity due to damage or impairment (e.g., crushed or bent inlets, flattened dips due to road grading).
      - Decreased structural integrity of ditch drain (relief) culverts, waterbreaks, or other road drainage structures (e.g., excessive pipe corrosion, breached water-breaks, or rutted road segments).

- Ditch scour or downcutting resulting from excessively long undrained ditches with infrequent ditch drain (relief) culverts or other outlet structures or facilities. This condition can also result from design inadequacies (e.g., spacing not altered for steep ditch gradient), inadequate erosion prevention practices (e.g., lack of armoring), or ditches located in areas of erodible soils.

4. **Determination regarding whether the restoration would be a net benefit to waters of the state.**

   a. To determine whether restoration would be a net benefit to waters of the state, landowners must weigh the ecological impacts of accessing and addressing the high-priority location against the value of vacating the high-priority locations.

   b. This analysis will be presented as part of the annual reporting process.

5. **Determination regarding the practicability of restoration/remediation.**

   a. To determine practicability, landowners must evaluate the financial expense and environmental benefit for a range of alternatives. These alternatives could include no action, vacating the high-priority location, and any other reasonable mitigation alternatives to address identified risks, including but not limited to:

      1) Ongoing stream diversions at stream crossings;

      2) Diversion potential at stream crossings;

      3) Likelihood of hydrologic connectivity;

      4) Comparative risk of chronic sediment produced; and

      5) Risk of contribution to mass wasting.

   b. Landowners must then propose the most practicable alternative from this analysis as part of the annual reporting process.

Step 5) If conditions are met, identified problems shall be remediated in the FRIA process (Years 0-20).

In consultation with ODF, if the landowner determines that all four of the following conditions are met, then the project will be scheduled for remediation in the FRIA process through the Annual Reports and Plans (Year 1–20):

1. The high-priority location is an abandoned road;

2. The high-priority location is actively contributing or has a high risk of contributing significant quantities of sediment to waters of the state;

3. The restoration would be a net benefit to waters of the state; and

4. Restoration is practicable.

4.3.5 Hydrologic Connectivity in Forest Practice Rules (FPR) Revisions and Proposed Inventory Processes

Hydrologic connectivity occurs where road and ditch runoff is delivered to the natural stream channel system. Roads can generate overland flow due to the relatively impermeable surface of the road prism and can also intercept interflow at cutslopes, effectively converting subsurface flows to surface flows. When these surface flows have a continuous flow path between the road prism and a natural stream channel, hydrologic connectivity occurs (Furniss et al., 2000, pp. 5-6). As Furniss et al. describe, "a hydrologically connected road becomes part of the stream network" (pp. 5-6).

Hydrologically connected roads can deliver increased runoff, sediment, and chemicals associated with roads, such as spills or oils generated on the road surface or cutslope. At the watershed scale, connections between roads and streams can also alter the drainage density of the watershed and change runoff frequency and magnitude (See Furniss et al., 2000; Weaver et al., 2015).

The Authors agree that the goal of disconnecting roads and streams is to minimize sediment delivery, hydrologic change, and risk of road pollutants entering waters of the state.

4.3.5.1 Summary of Rule Revisions and Process Changes to Address Hydrologic Connectivity

See Section 4.4 for complete text of proposed rule revisions. The requirement to hydrologically disconnect all forest roads and landings from waters of the state to the maximum extent practicable was added in several sections of the FPRs as established consistent with this Chapter including the goals, defining the term in rule, and as well as new rules pertaining to crossings. The Authors also added requirements to develop specific technical guidance, training, and monitoring protocols for hydrologic connectivity.

4.3.6 Updates Due to Natural Disasters

If a landowner experiences a natural disaster, they shall evaluate the area impacted and adjust their prioritization and schedule based on the changed circumstances as part of the annual reporting and planning process. If the scale of the disaster is significant enough where that timeframe is not feasible, the landowner may propose a different timeline with concurrence from ODF.

4.3.7 Stakeholder Processes

4.3.7.1 High-Priority and High-Risk Abandoned Roads Stakeholder Process

In Step 1 of the proposed Abandoned Roads process, the State in coordination with EPA and landowners will identify locations associated with abandoned roads that have a high level of risk to waters of the state or to infrastructure (See Section 4.3.4).

Concurrently, the state will convene a stakeholder process and invite landowners, state agencies, Tribes, conservation groups, and other interested stakeholders to determine the criteria to prioritize those identified high-risk abandoned roads (Step 2).

Considerations should include:

1. Importance of the watershed (HUC-6) to recovering salmonids;
2. Number of stream crossings based on full-densified stream network in GIS or LiDAR;
3. Cost and benefit of work to remediate problems and risks; and
4. Other relevant criteria as determined by ODF in consultation with other state and federal agencies [developed in a stakeholder process].

The result of this process will yield a set of high-priority abandoned road locations from the identified high-risk locations in Step 1.

4.3.7.2 Development of Rule Implementation Guidance

The Oregon Department of Forestry shall convene a stakeholder process to inform the development of implementation guidance for the following topics. Operations consistent with final technical guidance from ODF are determined to be consistent with the relevant rule. As allowed by rule, operators may diverge from technical guidance where alternative approaches are applied due to site specific conditions. The stakeholder process shall invite Representatives from conservation, fishing, Tribes, landowners, operators, and regulatory agencies with expertise in implementation of best management practices on forest roads.

1. Hydrologic Disconnection: Following revisions to the FPRs, ODF shall create new technical guidance or revise existing guidance (e.g., ODF Tech Note 8) to provide more technical information about implementation of hydrologic disconnection standards that are referred to/incorporated by rule.

2. Abandoned Roads: Following revisions to the FPRs, ODF in consultation with other state agencies including but not limited to Oregon Department of Environmental Quality

(DEQ), shall create new technical guidance or revise existing guidance regarding the proposed Abandoned Roads process (See Section 5.3.4).

3. Construction in Wetlands: Following revisions to the FPRs, ODF in consultation with other state agencies shall create new technical guidance or revise existing guidance regarding construction in wetlands.

4. Review of Existing ODF Tech Notes: Following revisions to the FPRs, ODF shall review and update existing technical guidance for compliance with new rules:

- ODF Tech Note 3 (2001): Replacing Stream Crossing Structures Outside Normal In-Water Working Periods
- ODF Tech Note 4 (in process): Fish Passage Guidelines for New and Replacement Stream Crossing Structures
- ODF Tech Note 5 (2002): Determining the 50-Year Peak Flow and Stream Crossing Structure Size for New and Replacement Crossings
- ODF Tech Note 7 (2003, edited 2019): Avoiding Roads in Critical Locations
- ODF Tech Note 8 (2003): Installation and Maintenance of Cross Drainage Systems on Forest Roads
- ODF Tech Note 9 (2003): Wet Weather Road Use

5. Adaptive Management: Additional items as identified under the adaptive management framework established under Chapter 10 of this Report.

4.3.9 Development of Training Requirements

ODF shall provide training opportunities for forest landowners and operators on the revised rules including but not limited to:

- Hydrological disconnection; and

FRIA methods and protocols.

4.3.10 Development of Monitoring Requirements

The Independent Research Science Team (IRST) created under the PFA shall design and oversee baseline and trend monitoring for hydrologic disconnection. Compliance monitoring will be conducted through the Department's process.

1. Baseline and Trend Monitoring for Hydrologic Disconnection: The methodology for the monitoring shall be based off of Dube et al. (2010) and Martin (2009). The purpose of the monitoring for hydrologic disconnection is to establish a baseline and to monitor and report the change in hydrologic connectivity over time as the FRIA is implemented. The overarching goal is to ensure that all forest roads and landings shall be hydrologically disconnected to the maximum extent feasible from waters of the state. The Adaptive Management Program Committee shall use the results of the baseline and trend monitoring to develop regional goals consistent with that monitoring. All hydrologic connectivity data should be public and shared as it becomes available to help focus goals, identify accomplishments, and inform statewide learning.

2. Compliance Monitoring: Site-specific and watershed assessments of implementation of FPRs and BMPs shall be conducted in accordance with FPR requirements and the processes outlined in Chapter 8.

4.4 Revised Rules in Conformance with Private Forest Accord Commitments

Oregon's regulations for forest roads offer a comprehensive suite of best management practices to ensure the protection of public resources. Clear, specific, measurable, objective, and enforceable rules are critical for proper application by practitioners and for transparency to the public. The proposed changes to Oregon's forest road rules that reflect this intent are included below. The Authors recognize that ODF may make minor modifications in rule writing that adhere to the intentions established in this Chapter by the Authors.

OAR 629-600-0100
Definitions

Hydrologic disconnection means the removal of direct routes of drainage or overland flow of road runoff to waters of the state.

OAR 629-625-0100
Written Plans for Road Construction

(1) A properly located, designed, and constructed road greatly reduces potential impacts to water quality, forest productivity, fish, and wildlife habitat. To prevent improperly located, designed, or constructed roads, a written plan is required in the sections listed below.

(2) In addition to the requirements of the water protection rules, operators must submit a written plan to the State Forester before:

(a) Constructing a road where there is an apparent risk of road-generated materials entering waters of the state from direct placement, rolling, falling, blasting, landslide or debris flow;

(b) Conducting machine activity in Type F, Type SSBT, or Type D streams, Type N streams, lakes, or significant wetlands; or

(c) Constructing roads in riparian management areas.

(d) Operators shall consult Tech Note 4 for required information to be included in written plans for water crossings.

(e) Constructing any water crossing in all typed waters and lakes, bays, ponds, impounding reservoirs, springs, rivers, streams, creeks, estuaries, marshes, wetlands, inlets, and canals.

(f) Constructing roads in critical locations.

(3) Operators shall submit a written plan to the State Forester before constructing roads on high landslide hazard locations. Operators and the State Forester shall share responsibility to identify high landslide hazard locations and to determine if there is public safety exposure from shallow, rapidly moving landslides using methods described in OAR 629-623-0000 through 0300. If there is public safety exposure, then the practices described in 629-623-0400 through 0800 shall also apply.

(4) In addition to the requirements of the water protection rules, operators shall submit a written plan to the State Forester before placing woody debris or boulders in stream channels for stream enhancement.

OAR 629-625-0200
Road Location

(1) The purpose of this rule is to ensure roads are located where potential impacts to waters of the state are minimized and hydrologic connectivity between roads and waters of the state is reduced to the maximum extent practicable.

(2) When locating roads, operators shall designate road locations which minimize the risk of materials entering waters of the state and minimize disturbance to channels, lakes, wetlands and floodplains.

(3) **Critical Locations**. Operators shall avoid locating roads in critical locations. When alternate routes that avoid critical locations are not legally feasible due to ownership boundaries or other legal impediments, physically feasible due to safety considerations, or would have a greater environmental risk, operators may locate roads in critical locations. Critical locations include:

(i) High landslide hazard locations

(ii) Slopes over 60% with decomposed granite-type soils

(iii) Locations parallel to, and within an RMA or within 50 feet of stream channels or lakes, excluding crossings and approaches to crossings

(iv) Within Significant wetlands,[4] stream-associated wetlands,[5] or wetlands[6] greater than 0.25 acres in size

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[4] OAR 629-600-0100 (70) "Significant wetlands" means those wetland types listed in OAR 629-680-0310, that require site specific protection, as follows: (a) Wetlands that are larger than eight acres; (b) Estuaries; (c) Bogs; and (d) Important springs in eastern Oregon.
[5] OAR 629-600-0100 (77) "Stream-associated wetland" means a wetland that is not classified as significant and that is next to a stream.
[6] OAR 629-600-0100 (95) "Wetland" means those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation

(v) Any active stream channel, exclusive of stream crossings in compliance with OAR 629-625-320

(vi) Locations parallel to, and within 50 feet of, a stream channel or within an RMA for a distance exceeding 500 feet per mile of road length, exclusive of stream crossings in compliance with OAR 629-625-320. However, the distance of 500 feet per mile can be exceeded where there are no other nearby alternatives and the road can be located far enough from the stream to not affect the minimum RMA leave tree requirements, and also to allow effective sediment filtering.

(vii) High landslide hazard locations where rock is likely to be highly sheared or otherwise unstable so that it is not possible to excavate a stable cutslope. If such a cutslope failure may divert road surface drainage to a high landslide hazard location and could trigger a debris flow below the road with potential for delivery to a stream, that road should not be constructed unless the operator demonstrates that the cutslope can be stabilized by buttressing or other means

(viii) Locations cutting through the toe of active or recently active deep-seated landslide deposits and where a reactivated landslide would likely enter waters of the state

(ix) Highly dissected, steep slopes where it is not possible to fit the road to the topography with full bench end haul construction

(4) All road construction in critical locations shall be reviewed on site and reviewed by the Department with consultation from a qualified professional as appropriate for the site, including but not limited to ODF, DEQ, and ODFW. Onsite review must occur within 14 days, otherwise the operator may continue with operations consistent with written plan.

(5) All road construction in critical locations must be outlined in a written plan. The written plan shall include a narrative describing why alternative routes are not feasible or would have greater environmental risk.

(6) Operators shall minimize the number of stream crossings.

(7) To reduce the duplication of road systems and associated ground disturbance, operators shall make use of existing roads where practical. Where roads traverse land in another ownership and will adequately serve the operation, investigate options for using those roads before constructing new roads. Notifications that include new road construction shall affirm that options, if they exist, were investigated.

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typically adapted for life in saturated soil conditions. Wetlands include marshes, swamps, bogs, and similar areas. Wetlands do not include water developments as defined in section (93) of this rule.

OAR 629-625-0310
Road Prism

(1) Operators shall use variable grades and alignments to avoid less suitable terrain so that the road prism is the least disturbing to protected resources, avoids steep sidehill areas, wet areas, and potentially unstable areas as safe, effective vehicle use requirements allow.

(2) Operators shall end-haul excess material from steep slopes or high landslide hazard locations where needed to prevent landslides.

(3) Operators shall design roads no wider than necessary to accommodate the anticipated use and minimize impacts to covered species from new road construction. The running surface width should average not more than thirty-two feet for double lane roads and twenty feet for single lane roads, exclusive of ditches plus any additional width necessary for safe operations on curves, turnouts, and landings.

(4) Operators shall design cut and fill slopes to minimize the risk of landslides.

(5) Operators shall stabilize road fills as needed to prevent fill failure and subsequent damage to waters of the state using compaction, buttressing, subsurface drainage, rock facing or other effective means.

(6) Operators shall utilize end-haul construction and not place fill within the riparian management area of a stream or within 75 feet of a stream channel where a riparian management area is not required. Fill may be placed in the riparian management area or within 75 feet of streams where a riparian management area is not required for approaches to crossings and at crossings.

OAR 629-625-0320
Water Crossing Structures

(1) All new or reconstructed water crossings in all typed waters and lakes, bays, ponds, impounding reservoirs, springs, rivers, streams, creeks, estuaries, marshes, wetlands, inlets, and canals shall have a written plan reviewed by ODF. Operators shall consult Tech Note 4 for guidance on developing written plans.

(2) In addition to the written plan requirements of OAR 629-605-0170 (Statutory Written Plans), the written plan for water crossings shall include an assessment of:

> (a) Operator transportation needs, road location, road management objectives, and land ownership;
>
> (b) The specific resource(s) that may be impacted by construction or reconstruction of the water crossing, including aquatic species, habitats, and conditions; floodplain values, terrestrial species, and water uses;
>
> (c) The specific risk factors at the watershed-scale, including geologic or geomorphic hazards, event history, past and projected land management, crossing maintenance history,

regional channel stability, and projected watershed conditions over the life of the crossing structure;

(d) The specific risk factors at the site scale, including channel stability, potential for blockage by debris, floodplain constriction, large elevation changes across infrastructure, channel sensitivity to change, consequences of site failure to resources, and potential stream geomorphic changes over the life of the crossing structure;

(e) The specific techniques and methods employed for resource protection;

(f) Additional information as determined by ODF.

(3) Operators shall design and construct all water crossing structures in all typed waters and lakes, bays, ponds, impounding reservoirs, springs, rivers, streams, creeks, estuaries, marshes, wetlands, inlets, and canals to:

(a) Minimize excavation of side slopes near the channel.

(b) Minimize the volume of material in the fill.

(A) Minimizing fill material is accomplished by restricting the width and height of the fill to the amount needed for safe use of the road by vehicles, and by providing adequate cover over the culvert or other drainage structure.

(B) Fills over 15 feet deep contain a large volume of material that can be a considerable risk to downstream beneficial uses if the material moves downstream by water. Consequently, for any fill over 15 feet deep, operators shall submit to the State Forester a written plan that describes the fill and drainage structure design. Written plans shall include a design that minimizes the likelihood of:

(i) Surface erosion;

(ii) Embankment failure; and

(iii) Downstream movement of fill material.

(C) Armor fills against erosion where large fills over 15 feet deep are determined to be necessary by ODF.

(c) Prevent erosion of the fill and channel.

(d) Minimize hydrologic connectivity for adjacent roadway.

(e) Avoid or minimize unavoidable alterations or disturbances to stream channel, bed, bank, or bank vegetation to that necessary to construct the water crossing structure. Alteration or disturbance of stream bed, bank, or bank vegetation shall be limited to that necessary to construct the project.

(f) The banks shall be revegetated with native woody species or stabilized with other erosion control techniques.

(g) Ensure that streamflow cannot be diverted out of its channel if the crossing fails.

(h) Preserve water quality and unobstructed flow.

(i) Wastewater from temporary water crossing project activities and dewatering shall be routed and deposited to the forest floor in an upland area, or above the 100-year flood level if present, to allow removal of fine sediment and other contaminants prior to being discharged to waters of the state.

(j) When ODF determines that installing a water crossing in a flowing stream will result in excessive siltation and turbidity, and siltation and turbidity would be reduced if stream flow were diverted, ODF shall require the stream flow be diverted using a bypass flume or culvert, or by pumping the stream flow around the work area. This may include culvert installations that are within 0.25 miles of a Type F or SSBT Water or within two miles of a hatchery intake.

(k) For water crossing structures on fish streams (Type F and SSBT), operators shall, consistent with the rules in this section:

(i) Minimize impacts to spawning and rearing habitat.

(ii) Minimize the loss of fish life during the project.

(iii) Ensure free and unimpeded fish passage at all flows when fish are expected to move through the life of the structure.

(iv) Avoid or minimize impacts to fish.

(4) In selecting a crossing design strategy, operators constructing or reconstructing crossings in all typed waters and lakes, bays, ponds, impounding reservoirs, springs, rivers, streams, creeks, estuaries, marshes, wetlands, inlets, and canals shall first consider vacating the water crossings. For water crossings in all fish streams (Type F and SSBT) where vacating the water crossing is not feasible or desired by the landowner, permanent channel-spanning structures shall be prioritized before other crossing strategies. This section does not require the landowner to utilize any specific crossing design strategy.

(5) Operators shall design and construct permanent water crossings to:

(a) Permanent water crossings in non-fish streams (Type N and D) shall be designed to pass the 100-year peak flow. Guidance for determining the 100-year peak flow shall be updated, at a minimum, every ten years to incorporate the most recent available peak flow data.

(b) Permanent water crossings in fish streams (Type F and SSBT) shall be designed using the stream simulation approach. Water crossing design in fish streams (Type F and SSBT) shall consider and incorporate the stream's geomorphic processes and anticipated changes over the life of the structure. Water crossings in fish streams (Type F and SSBT) shall be designed to allow for the movement of water, wood, sediment, and organisms to the maximum extent feasible and minimize obstacles to stream processes. Water crossings in fish streams (Type F and SSBT) shall avoid fragmentation of aquatic habitats by replicating the natural conditions of the stream being crossed. Where it is not possible to meet stream simulation, operators may propose alternatives so long as the flow can accommodate a 100-year peak flow and does not obstruct fish passage.

(c) ODF may require a larger crossing design if it determines that the structure size designed to pass the 100-year peak flow would be inadequate to:

> (i) avoid delivery of sediment to the water being crossed;
>
> (ii) avoid stream diversion potential; and
>
> (iii) provide opportunity for the passage of expected bed load and associated large woody debris during flood events;

(d) Permanent channel-spanning structures span the entire bankfull width of the stream. This water crossing strategy includes long and short-span bridges and open-bottom box culverts.

> (i) Permanent channel-spanning structures shall have a minimum of three feet of clearance between the bottom of the bridge structure and the water surface at the 100-year peak flow, unless engineering justification shows a lower clearance will allow the free passage of anticipated sediment and large wood.
>
> (ii) The bridge structure or stringers shall be placed in a manner to minimize damage to the bed.
>
> (iii) One end of each new or reconstructed permanent log or wood bridge shall be tied or firmly anchored if any of the bridge structure is within ten vertical feet of the 100-year flood level.
>
> (iv) When earthen materials are used for bridge surfacing, only clean sorted gravel may be used, a geotextile lining must be installed and curbs of sufficient size shall be installed to a height above the surface material to prevent surface material from falling into the stream bed.
>
> (v) Wood removed from the upstream end of bridges will be placed at the downstream end of bridges in such a way as to minimize obstruction of fish passage and to the extent practical, while avoiding significant disturbance of sediment in connection with maintenance activities.

(vi) Abutments, piers, piling, sills, approach fills, shall not constrict the flow so as to cause any appreciable increase (not to exceed 0.2 feet) in backwater elevation (calculated at the 100-year flood level) or channel wide scour and shall be aligned to cause the least effect on the hydraulics of the watercourse.

(vii) Excavation for and placement of the foundation and superstructure shall be outside the ordinary high-water line unless the construction site is separated from the stream by use of an approved dike, cofferdam, or similar structure.

(xi) Wood or other materials treated with preservatives shall be sufficiently cured to minimize leaching into the water or bed. The use of creosote or pentachlorophenol is not allowed. Structures containing concrete shall be sufficiently cured prior to contact with water to avoid leaching.

(xii) Permanent channel-spanning structures in fish streams (Type F and SSBT) shall be designed using the stream simulation approach. For fish streams (Type F and SSBT):

(1) Channel-spanning structures shall not constrict clearly defined channels;

(2) Channel-spanning structures shall establish a low-flow channel that will allow for fish movement during low-flow periods. In streams with highly variable flows, the structure shall be designed to pass high flows while maintaining a defined low-flow channel similar to the natural stream bed.

(e) Permanent water crossing culverts:

(i) Culverts shall be designed and installed so they will not cause scouring of the stream bed and erosion of the banks in the vicinity of the project.

(ii) The culvert shall be designed to avoid stream diversion potential.

(iii) The culvert and its associated embankments and fills must have sufficient erosion protection to withstand the 100-year peak flow. Erosion protection may include armored overflows or the use of clean coarse fill material.

(iv) Wood removed from the upstream end of culverts will be placed at the downstream end of culverts in such a way as to minimize obstruction of aquatic organism passage and to the extent practical, while avoiding significant disturbance of sediment in connection with maintenance activities.

(v) Disturbance of the bed and banks shall be limited to that necessary to place the culvert and any required channel modification associated with it. Affected bed and bank areas outside the culvert and associated fill shall be revegetated with native woody species, or stabilized with other erosion control techniques. Native woody species shall be maintained one growing season.

(vi) No permanent water crossing culverts shall be installed less than 18 inches.

(vii) Permanent culverts in fish streams (Type F and SSBT) shall be designed using the stream simulation approach. For fish streams (Type F and SSBT):

(1) For no-slope culverts, the minimum culvert diameter shall be at least equivalent to the active channel width. For other culvert installations, the minimum culvert diameter shall be at least 1.2 times the active channel width, plus 2 feet.

(2) Alignment and slope. The alignment and slope of the culvert shall mimic the natural flow of the stream whenever possible. 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 in a stream reach that represents natural conditions outside the zone of the road crossing influence.

(3) Embedment. If a culvert is used, the bottom of the culvert should be buried into the streambed not less than 30% and not more than 50% of the culvert height for round culverts and for pipe arch culverts not less than 15% and no more than 30%. For bottomless culverts, the footings or foundation must be designed for the deepest anticipated scour depth.

(4) Maximum length. If the design for a new crossing on a new road would require a culvert longer than 150 feet, a channel spanning structure shall be utilized unless the site-specific design constraints preclude the use of a channel spanning structure.

(5) Culvert bed materials. Culvert bed materials should have a similar composition to natural bed materials that form the natural stream channels adjacent to the road crossing in the reference reach. The culvert should be designed to deliver sufficient transported bed material to maintain the integrity of the streambed over time. If natural accumulation is not feasible, then culvert bed materials must be mechanically placed during bed construction.

(6) Water depth and velocity**.** The maximum velocity in the culvert should not exceed the maximum velocity in the narrowest channel cross-sections.

(g) **Fords**

(i) The entry and exit points of a new ford must not be within one hundred feet upstream or downstream of another ford.

(ii) Fords shall only be used during periods of no or low stream flow (whether dry or frozen) to minimize the delivery of sediment to the stream.

(iii) Fords shall only be installed in a dry streambed or when a site is de-watered and for which sediment control and flow routing plans have been developed, reviewed, and meet the criteria outlined in written plan.

(iv) Approaches to the structure should not dam the floodplain where substantial overbank flow occurs.

(v) The structure should cross as near to perpendicular to the channel to minimize the disturbance area and reduce maintenance for post-installation.

(vi) The structure should avoid or minimize the acceleration of flow velocities through the structure.

(vi) For fish streams (Type F and SSBT), any ford structure shall

(1) be no wider than 16 feet and

(2) installed and maintained to ensure scour has not created a barrier to fish passage.

(6) Operators shall design and construct temporary water crossings in conformance with the following:

(a) Temporary water crossings in non-fish streams (Type N and D) shall be designed to accommodate flows expected during crossing use with a minimum culvert diameter of 18 inches.

(b) Temporary water crossings in fish streams (Type F and SSBT) shall only be used during the ODFW in water work period.

(c) Temporary water crossings must be identified on the forest practices notification and written plan, along with a vacating date.

(d) Temporary crossings on Type N and D streams shall only be used:

(i) In Western Oregon if installed after June 1st and removed by September 30th of the same year;

(ii) In Eastern Oregon if installed after July 1st and removed by October 15th of the same year;

(iii) At other times when ODF and applicant can agree to specific dates of installation and removal, and the extended dates result in equivalent levels of resource protection.

(e) Temporary water crossings shall be installed in the dry, or in isolation from stream flow by the installation of a bypass flume or culvert, or by pumping the stream flow around the work area. An exception may be granted if siltation or turbidity is reduced by installing the culvert in the flowing stream. The bypass reach shall be limited to the minimum distance necessary to complete the project.

(f) Temporary water crossings shall be vacated to the specifications outlined in OAR 629-625-0650.

(g) ODF may waive removal of the water crossing if the applicant secures an amended written plan, and the structure and its approaches meet all of the requirements of a permanent water crossing structure.

(h) Disturbance of the bed and banks shall be limited to that necessary to place the temporary water crossing and any required channel modification associated with it.

(7) Other design strategies requiring additional approval

(a) Any alternative water crossing strategy that is not consistent with the above strategies shall be outlined in a plan for alternative practice, approved by ODF in consultation with ODFW.

(b) Alternative designs will be considered if they can be demonstrated to meet or exceed the proposed standards for the above strategies.

(8) Construction of Water Crossings

(a) Construction or reconstruction for all water crossings should comply with all relevant Forest Practice Rule (FPR) forest road requirements and ODF technical guidance before, during, and after construction. Nothing in this section affects existing requirements of ODFW.

(b) Stormwater, Erosion, and Sediment Control

(i) A site-specific erosion and sediment control plan is required as part of a written plan prior to beginning work. This plan may include but is not limited to a site plan with a description of the methods of erosion/sediment control; methods for confining, removing, and disposing of excess construction materials; or measures to disconnect road surface and ditch water from all typed waters and lakes, bays, ponds, impounding reservoirs, springs, rivers, streams, creeks, estuaries, marshes, wetlands, inlets, and canals.

(ii) Areas of bare soil, which could deliver sediment to all typed waters and lakes, bays, ponds, impounding reservoirs, springs, rivers, streams, creeks, estuaries, marshes, wetlands, inlets, and canals shall have effective drainage established or will be mulched and/or seeded before the start of the rainy season to reduce surface erosion. Native seed and invasive species-free mulch will be applied to sites with the potential for sediment delivery to all typed waters and lakes, bays, ponds, impounding reservoirs, springs, rivers, streams, creeks, estuaries, marshes, wetlands, inlets, and canals upon completion of construction. Invasive species-free mulch will be applied to stay in place.

(c) Pollution Control

(i) A spill prevention plan shall be required on site during construction. For guidance on developing a spill prevention plan, refer to ODF Tech Note 4.

(ii) Uncured concrete or concrete by-products shall not be allowed to enter waters of the state at any time during construction. All forms used for concrete shall be completely sealed to prevent uncured concrete from entering waters of the state.

(iii) Operators shall take measures to ensure that all materials and equipment used for construction, monitoring, and fish salvage are free of aquatic invasive species.

(iv) Wood treated with creosote or pentachlorophenol shall not be used for parts of the structure in or over the active channel, including pilings, beams, structural supports, and decking.

(v) No chemicals or any other toxic or harmful materials shall enter or leach into waters of the state.

(d) In-Water Work, Worksite Isolation, and Dewatering

(i) Water crossings in all typed waters and lakes, bays, ponds, impounding reservoirs, springs, rivers, streams, creeks, estuaries, marshes, wetlands, inlets, and canals require an in-water work plan in the written plan that includes but is not limited to: fish salvage, worksite isolation, and dewatering. The submitted written plan shall address in detail all in-channel construction activities and how the activities will adhere to all relevant Forest Practice Rule (FPR) forest road requirements, ODF technical guidance, and all relevant on-water work period requirements and guidelines from ODFW.

(ii) Operators shall adhere to ODFW-approved in-water work timing guidelines and the stream protection rules (OAR 629-625-0430) any time that construction activity is required within the active channel width.

(iii) For all water crossings in fish streams (Type F and SSBT):

(1) Worksite isolation.

(a) Any work area within the width of the bankfull channel must be isolated from water in the active channel whenever fish are reasonably certain to be present in a Type F or Type SSBT stream.

(b) Water crossings in fish streams (Type F and SSBT) with any type of stream bypass shall have an exclusion and recovery plan to ensure safe capture and relocation of fish trapped in the work zone when stream flow has been diverted.

(c) Prior to construction site dewatering, fish shall be captured and relocated to avoid direct mortality to the maximum extent practicable.

(d) Fish must be salvaged to the maximum extent practicable at any in-water construction site where dewatering and resulting isolation of fish may occur.

(e) All isolation features shall be removed after construction is completed. A written salvage report shall be submitted to ODF.

(2) Dewatering.

(a) Dewatering shall not be implemented in areas known to be occupied by lamprey, except where the operator submits a lamprey salvage plan to ODF in consultation with ODFW using guidance from ODF Tech Note 4.

(b) Dewatering of the isolated area shall be conducted in a manner that prevents sediment-laden water from reentering the stream.

(c) Dewatering shall be limited to the shortest linear extent of the stream as practicable.

(d) Dewatering shall be conducted over a sufficient period of time to allow species to naturally migrate out of the work area.

(9) Monitoring

(a) Landowners shall develop and implement a monitoring program for periodic inspections of all Type F and SSBT crossings.

(b) The program shall rely on visual inspection to confirm that the crossing is functional.

(c) The frequency of monitoring shall be no more than five years.

OAR 629-625-0330 (and OAR 629-625-0420)
Drainage

(1) All active, inactive, and vacated forest roads and landings shall be hydrologically disconnected to the maximum extent practicable from waters of the state to minimize sediment delivery from road runoff and reduce the potential for hydrological changes that alter the magnitude and frequency of runoff. This will be accomplished by locating drainage structures based on the priority listed below.

When there is a conflict between the requirements of sections (2) through (7) of this rule, the lowest numbered section takes precedence, and the later-numbered and conflicting section shall not be implemented.

(2) Cross-drains and ditch-relief culverts must not have stream diversion potential.

(3) Operators shall not concentrate road drainage water into headwalls, slide areas, high landslide hazard locations, or steep erodible fillslopes.

(4) Operators shall not divert water from stream channels into roadside ditches.

(5) Operators shall install drainage structures at approaches to stream crossings to divert road runoff from entering the stream. If placement of a single drainage structure cannot be placed in a location where it can effectively limit sediment from entering the stream, then additional drainage structures, road surfacing, controlling haul, or other site-specific measures shall be employed so that the drainage structure immediately prior to the crossing will effectively limit sediment from entering the stream. Best management practices to manage sediment at the outflow of the drainage structure nearest to the crossing may also be used.

(6) Operators shall provide drainage when roads cross or expose springs, seeps, or wet areas.

(7) Operators shall provide a drainage system that minimizes the development of gully erosion of the road prism or slopes below the road using grade reversals, surface sloping, ditches, culverts and/or waterbars as necessary. For new road construction, outsloping shall be used to the maximum extent practicable when site specific conditions allow for its safe and effective use.

OAR 629-625-0410
Disposal of Waste Materials

(1) Operators shall place debris, sidecast, waste, and other excess materials associated with constructing, maintaining, or vacating roads in stable locations outside of the riparian management area where these materials may not enter all typed waters and lakes, bays, ponds, impounding reservoirs, springs, rivers, streams, creeks, estuaries, marshes, wetlands, inlets, and canals or otherwise degrade aquatic resources after construction.

(2) If other alternatives present are unstable or there is a higher potential for delivery of waste materials to all typed waters and lakes, bays, ponds, impounding reservoirs, springs, rivers, streams, creeks, estuaries, marshes, wetlands, inlets, and canals, operators may place waste materials within the riparian management area but no closer than 75 feet from all typed waters and lakes, bays, ponds, impounding reservoirs, springs, rivers, streams, creeks, estuaries, marshes, wetlands, inlets, and canals. Placement of waste materials within the riparian management area but no closer than 75 feet from a water of the state requires a written plan that describes site specific measures that prevent or minimize the entry of these materials to all typed waters and lakes, bays, ponds, impounding reservoirs, springs, rivers, streams, creeks, estuaries, marshes, wetlands, inlets, and canals.

(3) If a riparian management area is not required, operators shall place waste materials at a minimum of 75 feet from all typed waters and lakes, bays, ponds, impounding reservoirs, springs, rivers, streams, creeks, estuaries, marshes, wetlands, inlets, and canals.

(4) Temporary placement of waste materials within the riparian management area that is necessary for constructing or vacating roads and crossings requires a written plan that describes site specific measures that prevent or minimize the entry of these materials to waters of the state and the timeframe for removal of those waste materials.

(5) Woody debris, rocks, or other materials placed for erosion control or for habitat restoration are exempt from this provision.

OAR 629-625-0440
Stabilization

(1) Operators shall establish effective drainage to avoid potential delivery of sediment to waters of the state and stabilize exposed material which is potentially unstable or erodible by use of seeding, mulching, riprapping, leaving light slashing, pull-back, or other effective means, as soon as practicable after completing operations or prior to the start of the rainy season. These areas include, but are not limited to, unsurfaced road grades, cut slopes, fill slopes, ditchlines, waste disposal sites, rock pits, and other areas with the potential for sediment delivery to these waters.

(2) During wet periods, operators shall construct roads in a manner which prevents sediment from entering waters of the state.

(3) Operators shall not incorporate slash, logs, or other large quantities of organic material into road fills.

OAR 629-625-0600
Road Maintenance

(1) The purpose of this rule is to protect water quality and ensure hydrologic disconnection of roads from waters of the state to the maximum extent practicable by timely maintenance of all active and inactive roads. Road surface must be maintained as necessary to:

(a) Minimize erosion of the surface and the subgrade;

(b) Minimize direct delivery of surface water to waters of the state;

(c) Minimize sediment entry to waters of the state;

(d) Direct any groundwater that is captured by the road surface onto stable

portions of the forest floor;

(e) Ensure properly functioning and durable drainage features; and

(f) For existing roads with inboard ditch, avoid overcleaning of ditchlines.

(2) Operators shall inspect and maintain culvert inlets and outlets, drainage structures and ditches before and during the rainy season as necessary to diminish the likelihood of clogging and the possibility of washouts.

(3) Operators shall provide effective road surface drainage, such as water barring, surface crowning, constructing sediment barriers, or outsloping prior to the rainy and runoff seasons.

(4) When applying road oil or other surface stabilizing materials, operators shall plan and conduct the operation in a manner as to prevent entry of these materials into waters of the state.

(5) Operators shall maintain and repair active and inactive roads as needed to minimize damage to waters of the state. This may include maintenance and repair of all portions of the road prism during and after intense winter storms, as safety, weather, soil moisture, and other considerations permit.

(6) Operators shall place material removed from ditches in a stable location.

(7) Operators shall install drainage structures on ditches that are capturing groundwater.

(8) In order to maintain fish passage through water crossing structures, operators shall:

(a) Maintain conditions at the structures so that passage of adult and juvenile fish is not impaired during periods when fish movement normally occurs. This standard is required only for roads constructed or reconstructed after September 1994, but is encouraged for all other roads; and

(b) As reasonably practicable, keep structures cleared of woody debris and deposits of sediment that would impair fish passage.

(9) Where needed to protect water quality, as directed by the State Forester, operators shall place additional cross drainage structures on existing active roads within their ownership prior to hauling to meet the requirements of OAR 629-625-0330.

(10) Other fish passage requirements under the authority of ORS 509.580 through 509.910 and OAR 635-412-0005 through 635-412-0040 that are administered by other state agencies may be applicable to water crossing structures, including those constructed before September 1, 1994.

OAR 629-625-0650
Vacating Forest Roads

(1) The purpose of this rule is to ensure that when landowners choose to vacate roads under their control, the roads are left in a condition where road-related damage to waters of the state is unlikely.

(2) To vacate a forest road, landowners shall effectively block the road to prevent continued use by vehicular traffic, and shall take all reasonable actions to leave the road in a condition where road-related damage to waters of the state is unlikely.

(3) To vacate a water crossing, landowners shall completely and permanently remove all water crossing structures, including bridges, culverts, fords, and associated fills. Vacating water crossings will re-establish the natural drainage with no additional maintenance required.

(4) A vacated road is a road which the forest landowner has vacated in accordance with procedures of (a) through (c) of this subsection:

(a) Roads are outsloped, water barred, storm-proofed, or otherwise left in a condition suitable to control erosion and maintain water movement within wetlands and natural drainages;

(b) Ditches are left in a suitable condition to reduce erosion;

(c) Water crossing structures and fills on waters of the state are removed, except where ODF determines other measures would provide adequate protection to public resources; and

(5) A vacated water crossing is a crossing which the forest landowner has vacated in accordance with procedures (a) through (n) of this subsection:

(a) Re-establish channel connectivity;

(b) Ensure compliance with existing in-water work periods requirements;

(c) Ensure that vacating does not result in a fish passage barrier;

(d) Completely remove the water crossing structures and all imported road fill material;

(e) Re-slope the banks to the original valley width, or at a minimum, restore the flood-prone width of the stream to its natural capacity;

(f) Re-vegetate and/or replant exposed stream banks or valley walls with native trees and shrubs to help expedite development of a functioning riparian condition;

(g) Establish a natural transition to the channel upstream and downstream of the crossing;

(h) Create a channel that is similar in size and configuration to channel conditions upstream and downstream;

(i) Incorporate large wood, if appropriate, to expedite restoration of the channel and fish habitat;

(j) Ensure stable side slopes that do not exceed 2:1, unless matching the natural stream bank or valley walls;

(k) Re-establish the natural streambed as close to the original location as possible so it matches the up and downstream width and gradient characteristics;

(l) Require erosion control to address sediment delivery from exposed slopes; and

(m) Place all excavated material in stable locations and outside of the floodplain.

(n) Ensure zero or near-zero hydrologic connectivity at the entire site.

(5) The landowner shall notify ODF that a road or crossing has been vacated. ODF has 30 days to determine whether the road or crossing has been vacated and to notify the landowner in writing. If ODF does not respond within 30 days, the road is presumed to be vacated.

(6) Roads and crossings are exempt from maintenance under this section only after (5) of this section is completed.

[NEW RULE SECTION]

OAR 629-625-XXX
Construction in Wetlands

(1) Avoid or minimize all road and landing construction near or within Significant wetlands,[7] stream-associated wetlands,[8] or wetlands[9] greater than 0.25 acres in size. Where impacts are unavoidable, they must be first minimized and then mitigated in the following priority order:

(a) Avoid impacts to Significant wetlands, stream-associated wetlands, and wetlands greater than 0.25 acres in size by selecting the least environmentally damaging landing location, road location and road length. Landowners must attempt to minimize road length when avoiding wetlands; or

(b) When road or landing construction in a Significant wetland, stream-associated wetland, or wetlands greater than 0.25 acres in size cannot be avoided, the operator shall build a temporary road that:

(i) Minimizes impacts by reducing the subgrade width, fill acreage and spoil areas; and

(ii) Removes temporary fills or road sections upon the completion of the project.

(c) Permanent road construction in a Significant wetland, stream-associated wetland, or

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[7] OAR 629-600-0100 (70) "Significant wetlands" means those wetland types listed in OAR 629-680-0310, that require site specific protection, as follows: (a) Wetlands that are larger than eight acres; (b) Estuaries; (c) Bogs; and (d) Important springs in eastern Oregon.
[8] OAR 629-600-0100 (77) "Stream-associated wetland" means a wetland that is not classified as significant and that is next to a stream.
[9] OAR 629-600-0100 (95) "Wetland" means those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands include marshes, swamps, bogs, and similar areas. Wetlands do not include water developments as defined in section (93) of this rule.

wetlands greater than 0.25 acres in size must be mitigated by:

(i) Reducing or eliminating impacts over time by preserving or maintaining areas; or

(ii) Replacing affected areas by creating new wetlands or enhancing existing

wetlands.

(iii) Filling or draining more than 0.25 acres of a Significant wetland, any stream-associated wetland, or any wetlands greater than 0.25 acres in size requires replacement by substitution or enhancement of the lost wetland functions and values at the road or landing construction site. The objective of successful replacement by substitution of lost wetland area will be generally on a two-for-one basis and of the same type and in the same general location. The objective of enhancing wetlands function is to provide for an equivalent amount of function and values to replace that which is lost.

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CHAPTER 5: SMALL FORESTLAND OWNERS

5.1 Introduction

This chapter establishes a program for Small Forestland Owners (SFOs). It recognizes that Oregon's SFOs value their properties for a diverse array of benefits, including but not limited to timber production. The SFO program is designed to ensure that management of these lands achieves the objectives of the Habitat Conservation Plan (HCP) envisioned by the Private Forest Accord, and also to address the potentially disparate financial impacts that an HCP could have on some SFOs.

An estimated 3.6 million acres of Oregon's forestlands are owned by landowners who own less than 5,000 acres. This equates to approximately 12% of Oregon's total forestlands, and 35% of the state's privately-owned forestlands (OFRI 2021). Compared to industrial forestland owners, most SFOs harvest less often. The 12% of total forestlands owned by SFOs produce approximately 11% of total timber harvested from all land ownerships. The 22% of total forestlands owned by private industrial owners produces 65% of total timber harvested from all land ownerships (OFRI 2021). The spatial footprint of a harvest on an SFO's property is widely known to be considerably smaller, on average, than the size of the mean harvest on industrial ownerships.

The lower rates of harvests found on SFO properties are indicative of the diversity of values of the owners. SFOs value their properties for numerous reasons beyond simply the harvesting of forest products. These values include recreation, wildlife habitat, and ecological values. Nevertheless, many SFOs also rely on their properties as investments and/or supplemental sources of income (Edwards and Bliss, 2003; Elwood et al., 2003; Fischer, 2012; Fisher and Bliss, 2008; Fisher and Charnley, 2010).

The Authors agree that the State of Oregon should prioritize data collection and transparency on key SFO issues, such as rate of compliance with the Forest Practices Act and the adequacy of culverts for fish passage. Due to potential difficulties in assessing the full size of an individual's ownership, particularly if it is divided between multiple parcels or ownership entities, care will be needed to ensure individuals truly meet the SFO designation requirements set forth in this report.


Brian Kelley

5.1.2 Designation of a Small Forestland Owner (SFO) for Purposes of this Report

There are multiple definitions and designations of SFOs in statute. The below criteria for designating an SFO are not intended to displace any of these pre-existing statutory provisions. Rather, the criteria below are intended to only apply for determining whether a landowner qualifies as an SFO for the purposes of this Chapter.

a. **Small Forestland Owner**: For the purposes of this Report, a "Small Forestland Owner" means a landowner that:

   1. Owns or holds in common ownership less than 5,000 acres of forestland in this state, and

   2. Has harvested no more than an average yearly volume of two million board feet of merchantable forest products from the landowner's forestlands in Oregon, when averaged over the three years prior to:

      a. The date the Oregon Department of Forestry (ODF) receives a harvest notification from the landowner; or

      b. If applying for a Small Forestland Investment in Stream Habitat (SFISH) Program grant, the date the landowner submits a grant application.

   And,

3. Certifies that they do not expect to exceed an average yearly volume of two million board feet of merchantable forest products to be harvested from the landowner's forestlands for ten years after ODF receives the harvest notification or grant application.

4. **Emergency exception:** Any landowner who exceeds the two million board feet average harvest threshold from their land in the three years prior to submitting a harvest notification or grant application to ODF, or who expects to exceed the threshold during any of the following ten years, shall still be deemed a "small forestland owner" if the landowner establishes to ODF's reasonable satisfaction that the harvest limits were, or will be, exceeded in order to raise funds to pay estate taxes or for a compelling and unexpected obligation, such as for a court-ordered judgment or for extraordinary medical expenses.

5.2 Goals

The primary goal of the SFO Program is to meet all of the objectives identified in the other chapters of this Report as well as the objectives of the Habitat Conservation Plan (HCP) envisioned by the Private Forest Accord. Given the inherent differences between SFOs and large industrial landowners, the Private Forest Accord framework envisions some different standards and strategies for SFOs, including differences in riparian and slope management requirements, eligibility for incentive programs, requirements for reporting, road measures, and the use of targeted outreach and educational efforts. It also proposes the establishment of the Small Forestland Owner Assistance Office, which will be a central administrative office at ODF to work with the broader community of both landowners who may be designated SFOs for purposes of this Report and other landowners of small forestlands.

Two additional goals for the SFO Program are to:

1) **Encourage adoption of standard harvest and road management rules:** While the Private Forest Accord framework includes optional prescriptions for SFOs who may face disproportionate economic impact from new harvest rules, it is also a goal of the program to provide SFOs with financial and educational encouragement to adopt standard harvest and road management rules. By selecting the standard harvest and road management rules that apply to large forest owners, SFOs will optimize environmental benefits and mitigate risks to natural resources that will most effectively meet the objectives of the Habitat Conservation Plan (HCP) envisioned by the Private Forest Accord.

2) **Minimize the conversion of timberlands to other uses:** Socioeconomic factors that result in increased demand for residential, commercial, and industrial development can lead to the conversion of forestlands to developed land uses (Kline and Alig 2005). Small forestlands provide an important suite of economic and ecological benefits to Oregon. These benefits can be diminished if small forestlands are converted to other land uses, such as residential subdivisions. While conversion to other land uses may occur for a wide variety of reasons, including the cost associated with forest ownership, the SFO Program seeks to diminish such conversion through a system of incentives, education, and regulatory stability for SFOs.

5.3 Private Forest Accord Commitments

5.3.1 Riparian Commitments

Chapter 2 of this Report identifies the Standard Practice that the Authors have agreed will apply when timber is harvested around riparian areas. SFOs may follow the Standard Practice as defined in Chapter 2, but they will also have two additional options related to riparian management. Aligned with the goals of this Chapter and the objectives of the envisioned HCP, SFOs may manage timber harvest around riparian areas under the Standard Practice Option in order to optimize environmental benefits and mitigate risks to natural resources, select the SFO Minimum Option, or select the Forest Conservation Credit (FCC) Option as defined below.

The following three options to manage timber harvest around riparian areas are available to SFOs:

1) **Standard Practice Option:** SFOs may choose to follow the Standard Practice used by large forest owners to manage timber harvest around riparian areas established under Chapters 2 and 3 of this Report.

2) **SFO Minimum Option:** SFOs may choose to manage to alternative minimum rules as defined below. This shall be known as the SFO Minimum Option.

3) **Forest Conservation Credit Option:** SFOs may choose to follow the Standard Practice used by large forest owners and claim a tax credit for some of the value committed to conservation. This shall be known as the Forest Conservation Credit (FCC) Option.

5.3.1.1 Statewide Riparian Prescriptions

This subsection establishes general riparian prescriptions that apply statewide to both Western and Eastern Oregon for SFOs.

a. For Type 1, 2, or 3 timber harvests that include a riparian area covered under the revised PFA rules as established in this Report, a landowner who qualifies as an SFO is encouraged to follow the Standard Practice Option. Landowners who qualify as an SFO may also select the SFO Minimum Option or the FCC Option.

b. SFOs who choose the SFO Minimum Option may harvest using the alternative prescriptions identified for Western Oregon in Section 5.3.1.3. The dividing line between Eastern and Western Oregon shall be the summit of the Cascade Mountains.

c. The use of the SFO Minimum Option will be limited to 5% of the horizontal lineal feet of streams owned by SFOs, over a five-year rolling average, in a defined fifth field watershed. The 5% will be tracked by ODF separately for fish and non-fish streams. These limits are further established under Section 5.3.4 "Requirements and Limitations on the Use of the SFO Minimum Option."

d. SFOs who select the FCC Option must follow the same prescriptions as the Standard Practice, but can apply for a Forest Conservation Credit for 100% of the Stumpage Value of merchantable forest products retained under the Standard Practice in excess to what would be retained under the SFO Minimum Option, in addition to the credits identified in Section 5.3.1.3(a)(2). *See generally* Tables 1 and 2 below.

e. Undesignated harvests are not eligible to claim a Forest Conservation Credit. There will be no limitations on the use of an Undesignated harvest within a Fifth Field Watershed.

5.3.1.2 Measurement of Riparian Prescriptions

a. Riparian Management Area (RMA) Widths

All measurements of RMA widths shall be made using slope distance and shall be measured from the edge of the active channel or channel migration zone (CMZ), if present. The definition of CMZ is established in Chapter 2 of this Report. The RMA width shall be measured separately on each side of the stream.

b. Riparian Management Area Lengths

The measurements of RMA lengths on small perennial non-fish (Type Np) streams start from their confluence with the Type F or Type SSBT junction.

c. Forest Conservation Credit (FCC) Option

The area that may be eligible for the tax credit under the FCC Option is termed the Forest Conservation Area (FCA). The width of the FCA is the difference between the outermost edge of the Standard Practice Width and the outermost edge of the SFO Minimum Option Width. The length of the FCA is the length of frontage that follows the same lengths as the Standard Practice Option. Additional credits may be claimed in accordance with Section 5.3.1.3(a)(2).

5.3.1.3 Western Oregon Riparian Prescriptions for SFOs

The table below establishes the riparian prescriptions for SFOs in Western Oregon under the Standard Practice Option and the SFO Minimum Option, and the area that may be eligible for a tax credit under the FCC Option, which is termed the Forest Conservation Area (FCA).

Table 1. Western Oregon RMAs for SFOs[1]

Stream Type	Standard Practice Width	SFO Minimum Option Width	Forest Conservation Area[2]
Large SSBT	110 feet no harvest	100 feet no harvest	Area between 100 and 110 feet
Medium SSBT	110 feet no harvest	80 feet no harvest	Area between 80 and 110 feet
Small SSBT	100 feet no harvest	60 feet no harvest	Area between 60 and 100 feet
Large Type F	110 feet no harvest	100 feet no harvest	Area between 100 and 110 feet
Medium Type F	110 feet no harvest	70 feet no harvest	Area between 70 and 110 feet
Small Type F	100 feet no harvest	50 feet no harvest	Area between 50 and 100 feet
Large Type N	75 feet no harvest	70 feet no harvest	Area between 70 and 75 feet
Medium Type N	75 feet no harvest	50 feet no harvest	Area between 50 and 75 feet
Small Type Np, Tributary to SSBT	A 75-foot wide no-harvest RMA from the confluence with the SSBT stream for the first 500 feet, then a 50-foot wide no harvest RMA on the next 650 feet, for a total of up to 1,150' (the "RH Max" applicable to a Western Oregon Small Type Np, tributary to SSBT), with an R-ELZ and ELZ as defined and further described in Chapter 2	A 35-foot wide no-harvest RMA from the confluence with the SSBT stream for the first 500 feet, then a 35-foot wide no harvest RMA on the next 650 feet, for a total of up to 1,150' (the "RH Max" applicable to a Western Oregon Small Type Np, tributary to SSBT), with an R-ELZ and ELZ as defined and further described in Chapter 2	**Width:** Area between 35 feet and the outside edge of the Standard Option (either 50 or 75 feet) **Length:** Will follow same lengths as the Standard Practice Option See also 5.3.1.3(a)(2) below re: dry segments.

Small Type Np, Tributary to Type F	A 75-foot wide no-harvest RMA from the confluence with the Type F stream for up to the first 600 feet (the "RH Max" applicable to a Western Oregon Small Type Np, tributary to a Type F), with an R-ELZ and ELZ as defined and further described in Chapter 2	A 35-foot wide no-harvest RMA from the confluence with the Type F stream for up to the first 600 feet (the "RH Max" applicable to a Western Oregon Small Type Np, tributary to a Type F), with an R-ELZ and ELZ as defined and further described in Chapter 2	**Width:** Area between 35 feet and the outside edge of the Standard Option **Length:** Will follow same lengths as the Standard Practice Option See also 5.3.1.3(a)(2) below re: dry segments.
Type Ns	35 feet equipment limitation zone	35 feet equipment limitation zone	None

1. All measurements of RMA widths shall be made using slope distance and shall be measured from the edge of the active channel or channel migration zone (CMZ), if present. The RMA width prescriptions established in Table 1 refer to the width of the RMA on one side of the stream (from the edge of the active channel or channel migration zone [CMZ], if present, upslope).

2. The width of the FCC Area is the difference between the outermost edge of the Standard Practice Width and the outermost edge of the SFO Minimum Option Width. The FCC Area is the length of frontage of the harvest unit on that stream type segment.

a. Non-Fish Perennial Stream Rules

Generally, SFOs will follow the same RMA rules for small non-fish perennial streams identified in Chapter 2 that apply to larger landowners, with the following additions:

1) If an Area of Inquiry extends beyond the SFO ownership boundary, and the last 100' before reaching the ownership boundary does not have a Flow Feature, then the no-harvest buffer will extend to the upper-most Flow Feature within the ownership boundary, or the RH Max, whichever is shorter, and an R-ELZ will extend beyond that to the ownership boundary; PROVIDED THAT prior surveys documented in ODF FERNS that evidence a Flow Feature upstream of the ownership boundary will alter the analysis per the above.

2) When a SFO selects the Standard Practice, and if 100' or more of surveyed dry channel between two Flow Features below the RH Max is given a no-harvest buffer, the SFO may apply for a Forest Conservation Credit (tax credit) for half of the stumpage value of the trees left between the inside edge of SFO Minimum Option (35' in Western Oregon) and the edge of the dry stream channel. The SFO may not cut trees within this inside zone in lieu of taking the tax credit.

b. Type Np Streams Upstream of RMAs and All Type Ns Streams

Whether and where a stream is defined as "perennial" will be determined under the methods established in Chapter 2. For sections of perennial streams upstream of the above identified RMAs and for seasonal streams, SFOs will follow the Standard Practice prescriptions identified in Chapter 2.

c. Seeps and Springs within RMAs

The Standard Option for seeps and springs found within RMAs is established in Chapter 2. SFOs may follow different prescriptions for seeps and springs found within RMAs under the SFO Minimum Option. The SFO Minimum Option requires that, if a seep or spring occurs within an RMA, then the RMA will be extended for 15 feet beyond the seep or spring, if the RMA is not already 15 feet beyond the seep or spring. ODF will provide a standardized form for SFOs to fill out when they do a harvest notification to guide the use of the SFO Minimum Option around seeps and springs. No tracking of this prescription is required as laid out in section 5.3.4 of this Chapter, related to the RMA SFO Option. There is no FCC option for additional seeps and springs buffers.

5.3.1.4 Eastern Oregon RMAs for SFOs

The table below establishes the riparian prescriptions for SFOs in Eastern Oregon under the Standard Practice Option and the SFO Minimum Option, and the area that may be eligible for a tax credit under the FCC Option, *i.e.* the Forest Conservation Area.

The Eastern Oregon riparian prescriptions establish an inner no-harvest zone and an outer managed-harvest zone. The basal area retentions in the outer managed harvest zone for the Standard Option are established in Chapter 2. The SFO Minimum Option requires the same basal area retentions in the outer managed-harvest zone as the Standard Option.

Table 2. Eastern Oregon RMAs for SFOs[1]

Stream Type	Standard Practice Width	SFO Minimum Option Width	Forest Conservation Area[2]
Large Type F and SSBT	30 feet no harvest and 70 feet managed area (100 feet total)	30 feet no harvest and 70 feet managed area (100 feet total)	None
Medium Type F and SSBT	30 feet no harvest and 70 feet managed area (100 feet total)	30 feet no harvest and 50 feet managed area (80 feet total)	Difference between 50 feet and 70 feet managed zone
Small Type F and SSBT	30 feet no cut and 45 feet managed area (75 feet total)	30 feet no harvest and 30 feet managed area (60 feet total)	Difference between 30 feet and 45 feet managed zone

Large Type N	30 feet no harvest and 45 feet managed area (75 feet total)	30 feet no harvest and 45 feet managed area (75 feet total)	None
Medium Type N	30 feet no harvest and 45 feet managed area (75 feet total)	30 feet no harvest and 30 feet managed area (60 feet total)	Difference between 30 feet and 45 feet managed zone
Small Type Np, Terminal[3]	A 30-foot inner no-harvest zone and 30-foot outer managed-harvest zone, for up to the first 500 feet length above junction with Type F or SSBT (the "RH Max" applicable to an Eastern Oregon Small Type Np Terminal), with an R-ELZ and ELZ as defined and further described below.	A 20-foot inner no-harvest zone and 20-foot outer managed-harvest zone, for up to the first 500 feet length above junction with Type F or SSBT (the "RH Max" applicable to an Eastern Oregon Small Type Np Terminal), with an R-ELZ and ELZ as defined and further described below.	None
Small Type Np, Lateral[4]	A 30-foot inner no-harvest zone for up to the first 250 feet length above junction with Type F or SSBT (the "RH Max" applicable to an Eastern Oregon Small Type Np Lateral), with an R-ELZ and ELZ as defined and further described below.	A 20-foot inner no-harvest zone for up to the first 250 feet length above junction with Type F or SSBT (the "RH Max" applicable to an Eastern Oregon Small Type Np Lateral), with an R-ELZ and ELZ as defined and further described below.	None
Small Type Ns	30 feet equipment limitation zone (ELZ). Within 30-foot ELZ, retain shrubs and trees under 6 inches DBH, where possible, for up to the first 750 feet length from the confluence with Type F or SSBT streams.	30 feet equipment limitation zone (ELZ). Within 30-foot ELZ, retain shrubs and trees under 6 inches DBH, where possible, for up to the first 750 feet length from the confluence with Type F or SSBT streams.	None

[1] All measurements of RMA widths shall be made using slope distance and shall be measured from the edge of the active channel or channel migration zone (CMZ), if present. The RMA width prescriptions established in Table 1 refer to the width of the RMA on one side of the stream (from the edge of the active channel or channel migration zone [CMZ)], if present, upslope).

[2] The area that may be eligible for the tax credit under the FCC Option is termed the Forest Conservation Credit Area. The width of the FCC Area is the difference between the outermost edge of the Standard Practice Width and the outermost edge of the SFO Minimum Option Width. The length of the FCC Area is the length of frontage of the harvest unit on that stream type segment.

[3]Terminal Type Np Streams are defined in Chapter 2.

[4] Lateral Type Np Streams are defined in Chapter 2.

a. Non-Fish Perennial Stream Rules

Generally, SFOs will follow the same RMA rules for small non-fish perennial streams identified in Chapter 2 that apply to larger landowners, with the following addition:

1) If an Area of Inquiry extends beyond the SFO ownership boundary, and the last 100' before reaching the ownership boundary does not have a Flow Feature, then the no-harvest buffer will extend to the upper-most Flow Feature within the ownership boundary, or the RH Max, whichever is shorter, and an R-ELZ will extend beyond that to the ownership boundary; PROVIDED THAT prior surveys documented in FERNS that evidence a Flow Feature upstream of the ownership boundary will alter the analysis per the above.

b. Type N Perennial Streams Upstream of Buffers and All Type N Seasonal streams

Whether and where a stream is defined as "perennial" will be determined under the methods established in Chapter 2. For sections of perennial streams upstream of the above identified buffers and for seasonal streams, SFOs will follow the Standard Practice prescriptions identified in Chapter 2. That Chapter also identifies an Eastern Oregon prescription for small Type N perennial streams that draws a distinction between laterals and terminals. The SFO Option adopts this approach and uses the same perennial identification rules.

c. Seeps or Springs Within RMAs

The Standard Option for seeps and springs found within RMAs is established in Chapter 2. SFOs may follow different prescriptions for seeps and springs found within RMAs under the SFO Minimum Option. The SFO Minimum Option requires that, if a seep or spring occurs within an RMA, then the RMA will be extended for 15 feet beyond the seep or spring, if the RMA is not already 15 feet beyond the seep or spring. ODF will provide a standardized form for SFOs to fill out when they do a harvest notification to guide the use of the SFO Minimum Option around seeps and springs. No tracking of this prescription is required as laid out in section 5.3.4 of this Chapter, related to the RMA SFO Option. There is no FCC option for additional seeps and springs buffers.

5.3.2 Timber Harvest on Steep Slopes Commitments

Chapter 3 of this Report identifies the Standard Practice that the Authors have agreed will apply when timber is harvested on steep slopes. This Report identifies the following three types of steep slopes prescription as defined in Chapter 3:

1) Designated Debris Flow Traversal Area;

2) Designated Sediment Source Area; and

3) Stream Adjacent Failures.

SFOs may choose to harvest timber on steep slopes under the Standard Practice Option in order to optimize environmental benefits and mitigate risks to natural resources. SFOs will have an alternative SFO Minimum Option for each of the three steep slopes prescriptions, as detailed below.

5.3.2.1 Modeling for Steep Slopes Prescriptions

For the purposes of the SFO Minimum Option steep slopes prescriptions, the modeling described in Chapter 3 will be used to determine prescription locations for Designated Debris Flow Traversal Areas and Designated Sediment Source Areas. The terms Designated Debris Flow Traversal Areas and Designated Sediment Source Areas will be given the same definitions and will be located in the same fashion as established in Chapter 3. SFOs will rely on the same FERNS maps to identify these features as would any other landowner.

5.3.2.2 Western Oregon SFO Minimum Option for Designated Debris Flow Traversal Areas

a. For Type 1, 2, or 3 Harvests, the SFO Minimum Option will require buffering of 50% of the length of the Designated Debris Flow Traversal Area that would be protected under the Standard Practice identified in Chapter 3. The width of the Debris Flow Traversal Area will be the same as the Standard Practice. This restriction applies at the harvest unit level.

b. ODF will determine if an SFO has a Designated Debris Flow Traversal Area in a planned harvest. ODF will assist SFOs in determining what areas need to be retained. The SFO Minimum Option is specific to each individual SFO, meaning that should a single Designated Debris Flow Traversal Area extend to a second SFO's property, each SFO shall protect half of the traversal path on their property, if they select the SFO Minimum Option.

c. There will be no Forest Conservation Credit available if an SFO chooses to use the Standard Practice for Designated Debris Flow Traversal Area.

d. There will be no Designated Debris Flow Traversal Area requirements for SFOs who have an Undesignated Harvest.

5.3.2.3 SFO Designated Sediment Source Areas

a. SFOs are exempt from the prescriptions identified in Chapter 3 related to Designated Sediment Source Areas. As such, SFOs are entitled to harvest within all Designated Sediment Source Areas on their properties.

5.3.2.4 Statewide SFO Minimum Option for Stream Adjacent Failures

a. Stream Adjacent Failures will be identified using the criteria identified in Chapter 3.

b. If a Stream Adjacent Failure is identified in an RMA, then the SFO will include an additional 30 feet within the RMA beyond the SFO Minimum Option or to the slope break, where applicable, whichever is shorter. The length of the RMA subject to the Stream Adjacent Failure prescription will be determined under the Standard Practice as established in Chapter 3.

c. ODF may assist SFOs in determining what areas need to be included in the RMA subject to the Stream Adjacent Failure prescription.

d. No tracking by fifth field watershed is required for this alternative prescription.

e. There will be no Forest Conservation Credit available if an SFO chooses to use the requirements in the Standard Practice for Stream Adjacent Failures.

5.3.2.5 Steep Slope Prescriptions in Eastern Oregon

a. There will be no steep slope prescriptions for Designated Debris Flow Traversal Areas or for Designated Sediment Source Areas for SFOs in Eastern Oregon. Eastern Oregon is defined as east of the summit of the Cascade Mountains.

b. The steep slope prescriptions for Stream Adjacent Failures established under 5.3.2.4 of this Chapter apply east of the summit of the Cascade Mountains.

5.3.3 Forest Conservation Credit Commitments

The Authors recognize the importance of SFOs to the State of Oregon. SFOs play a critical role in both land conservation as well as the forest products sector. Small forestland ownership is also culturally important to many Oregonians who take great pride in stewarding their forests. Financial hardships associated with the conservation commitments detailed in this Report have a high likelihood of disproportionately impacting some SFOs. These impacts may impact SFO decisions to convert their lands to non-forest uses, which often have more significant environmental impacts. Given these threats, this Report recognizes the need for durable financial assistance to SFOs to attain improved and durable conservation outcomes. The tax credit envisioned in this Report, termed the Forest Conservation Credit, is a critical element of the Private Forest Accord policy package.

The Forest Conservation Credit is established to incentivize SFOs to adopt the Standard Practice prescriptions provided for in this Report for riparian areas. When an SFO adopts the Standard Practice for management in those areas instead of the SFO Minimum Option, the SFO becomes eligible to receive a Forest Conservation Credit equal to the Stumpage Value, as defined in Appendix D, of the additional timber that is retained in the Forest Conservation Credit Area by adopting the Standard Practice.

Additional details regarding how the tax credit will function are identified in Appendix D to this Report, and many of the details are included in the PFA enabling legislation.

5.3.3.1 Duration of the Forest Conservation Credit (FCC)

It is the expectation of the Authors that the FCC will be available beginning on the date the rules implementing the provisions of this Report become operative, and will be continuously available until the termination of the envisioned 50-year HCP. The FCC will not have a sunset date. If a future legislature cancels the FCC and does not replace it with a similar compensation option for SFOs, all existing credits held by taxpayers will be retained by them and may still be used. Similarly, if the FCC program is canceled, all restrictions on using the SFO Minimum Option within a fifth field watershed will be removed for riparian areas where a credit has not been issued, though the frequency of harvests under the SFO Minimum Option will continue to be tracked. If a future legislature were to reinstate the Forest Conservation Credit, it is the expectation of the Authors that the system would be renewed.

5.3.4 Requirements and Limitations on the Use of the Riparian SFO Minimum Option

a. Reporting Requirements

ODF will create a standardized form that must be filled out by an SFO whenever the SFO Minimum Option is utilized for activities near riparian areas. The form will require identification of the horizontal lineal feet of riparian area in the harvest unit and whether the horizontal lineal distance is a two-sided harvest or a one-sided harvest. Within three months after the completion of the timber harvest, SFOs will report to ODF the actual horizontal lineal feet of riparian area where the SFO Minimum Option was used.

b. Fifth Field Watershed Cap

The use of the SFO Minimum Option will be limited to 5% of the horizontal lineal feet of streams owned by SFOs, over a five-year rolling average, in a defined fifth field watershed. The 5% will be tracked separately for fish and non-fish streams. ODF will track the actual horizontal lineal feet of riparian area managed using the SFO Minimum Option, in any fifth field watershed as discussed below. By rolling average it is intended that harvests occurring more than 5 years before are not used to calculate whether the cap has been reached, but instead harvests of that age will roll off the cap calculation.

c. SFO Minimum Option Tracking Distance and Reporting

Lineal feet will be tracked using each side of a stream such that a one-sided buffer will count as half the lineal feet of a stream segment. ODF will annually track and report the rolling average of fish (Type F and Type SSBT) and non-fish (Type N) streams managed using the SFO Minimum Option for each Fifth Field Watershed.

d. **Implications of Cap Being Reached**

Should the 5% threshold for the SFO Minimum Option in a fifth field watershed be reached, two options will exist for SFOs:

1) For an SFO that wants to utilize the SFO Minimum Option, they may elect to be placed on a waiting list to use the SFO Minimum Option in that fifth field watershed when the rolling 5-year threshold has lowered below 5%. This list will be maintained and updated by ODF on a first come, first served basis. SFOs will be notified by ODF when the opportunity to use the SFO Minimum Option becomes available. SFOs on the list will have priority to use the SFO Minimum Option before other SFOs, but once an SFO on the list is notified of the availability to use the option, they must elect to harvest or otherwise let other SFOs utilize the option.

2) The SFO can choose the FCC Option and receive a tax credit for 125% of the value that the SFO would have otherwise received utilizing the FCC Option.

5.3.5 SFO Forest Road Commitments

SFOs will comply with the Forest Practice Rules for forest roads as required to be established under Chapter 4 of this Report, with the following exceptions:

1) The Forest Road Inventory Assessment (FRIA) program identified in Chapter 4 will not apply to SFOs. Instead, SFOs will fill out a Road Condition Assessment (RCA) specific for SFOs, approved by Oregon Department of Forestry (ODF).

2) FRIA timelines for replacing or maintaining road infrastructure to the standards established in Chapter 4 will not apply to SFOs. However, SFOs will ensure that their roads are maintained to the standards of the Forest Practice Rules that are required to be established by this Report for any roads used for harvests. Culverts will be replaced consistent with Oregon law.

All new construction related to roads on forestland owned by SFOs must satisfy the same standards of the Forest Practice Rules for forest roads as required to be established under Chapter 4 of this Report.

5.3.5.1 Road Condition Assessments (RCAs)

a. The Forest Road Inventory Assessment (FRIA) program identified in Chapter 4 will not apply to SFOs. This includes the inventory and prioritization requirements, and the upgrade timeframes.

b. In lieu of FRIA, an SFO will fill out a Road Condition Assessment (RCA) worksheet when they submit a notification to ODF for a timber harvest that will result in the SFO using a road to haul timber. SFOs will be encouraged to complete an RCA without a planned timber harvest, but are not required to do so. The RCA worksheet will be a form that is developed and approved by ODF with stakeholder input. Notifications for activities other than timber harvest will not require an RCA.

c. The RCA will include all roads in the SFO's parcel where the harvest will take place and the condition of each road with specific regard to: 1) whether the road condition contributes to active or potential delivery of sediment to waters of the state and 2) the status of water crossings. ODF will assist SFOs in completing RCAs, when needed.

d. An RCA will also indicate potential fish passage barriers on fish streams (Type F and Type SSBT), abandoned roads, and roads with a perched fill that present a significant hazard to fish-bearing streams that may qualify for state funding. Potential fish passage barriers on fish streams (Type F and Type SSBT), abandoned roads, and roads with a perched fill that present a significant hazard to fish-bearing streams, identified in RCAs that may qualify for state funding grants will be reviewed by ODF in consultation with the Oregon Department of Fish and Wildlife (ODFW) for eligibility.

5.3.5.2 Road Condition Improvements

a. If a road on land owned by an SFO is used to haul timber, the SFO will ensure that their roads are maintained to the standards of the Forest Practice Rules that are required to be established under Chapter 4.

b. All new road construction must satisfy the same standards that apply to all landowners under the Forest Practice Rules that are required to be established under Chapter 4. Culverts will be replaced consistent with Oregon law.

c. The SFO is not required to undertake the three types of road improvements to be funded by the state:

    1) Replacement of fish stream culverts (Type F and Type SSBT);

    2) Repair of abandoned roads; or

    3) Reconstructing, vacating, or relocating roads with a perched fill that present a significant hazard to fish-bearing streams

   These road improvements will be 100% funded by the State and will be coordinated through the new Small Forestland Investment in Stream Habitat (SFISH) Program.

d. The timing of the above three types of projects will be dependent on the State's ability to fund and prioritize them.

e. If the State fails to fund eligible and approved projects on an SFO's road under the SFISH Program, the non-implementation of those projects will not preclude the SFO from using the road for any purpose unless:

   i. The road is actively delivering sediment to waters of the state; or

   ii. The road has one or more culverts with an imminent risk of failure, as defined in Chapter 4 of this Report.

f. If an RCA identifies necessary road repairs, there shall be no time limit in which the SFO must complete those repairs, though the obligation to improve roads when used for harvest remains.

5.3.5.3 Small Forestland Investment in Stream Habitat (SFISH) Program

a. The SFISH Program will be managed by the Small Forestland Owner (SFO) Assistance Office, in consultation with ODFW. State funding will be made available to qualified SFOs to: 1) replace fish stream culverts (Type F and Type SSBT) that are no longer functioning or still functioning but not designed consistent with the Forest Practice Rules required to be established consistent with this Report, 2) repair abandoned roads, and 3) reconstruct, vacate, or relocate roads with a perched fill that present a significant hazard to fish-bearing streams.

b. SFISH projects will be 100% funded by the State at the rate of $10 million per year. If state funding is not available, SFOs will have no obligation to make such repairs on their forestland until funding is available, unless otherwise required by the FPA. No more than 10% of available SFISH funds may be used for perched fill remediation projects in any year.

c. An outreach program through the Partnership for Forestry Education will be developed to inform SFOs about the SFISH Program and to encourage SFOs to voluntarily complete RCAs.

d. If an SFO submits an RCA, they will be eligible for participation in the SFISH program.

e. The SFO Assistance Office, in consultation with ODFW, will track projects identified in RCAs related to potential fish passage barriers on fish streams (Type F and Type SSBT), abandoned roads, and perched fill that present a significant hazard to fish-bearing streams that may qualify for state funding.

f. In order to optimize state funding that results in the greatest environmental benefits for covered species and mitigates risks to natural resources, the Assistance Office, in coordination with ODFW, will prioritize funding culvert replacements on fish streams, repair of abandoned roads, and perched fill that present a significant hazard to fish-bearing streams under the SFISH Program that are on high conservation value sites. Coordination and data sharing with other state agencies may be necessary to determine project prioritization. SFOs may also work with other partners to coordinate and plan projects funded by SFISH.

g. For purposes of the SFISH Program, a site will be designated a high conservation site if, upon evaluation under the SFISH Program, the site is identified as:

   1) An area of known chronic sedimentation;

   2) A fish passage barrier.;

   3) An ongoing stream diversion at stream crossings or an area with high stream diversion potential;

   4) An area of known hydrologic connectivity; or

   5) A road with a perched fill that presents a significant hazard to fish-bearing streams.

h. The SFISH Program will prioritize a project at a high conservation value site for funding if the project will:

   1) Remove fish passage barriers consistent with ODFW requirements under ORS 509.585 and OAR 635-412-0015 (2), as implemented through the Forest Practice Rules;

   2) Minimize the potential for sediment delivery to waters of the state;

   3) Minimize stream diversions at water crossings;

   4) Minimize hydrologic connectivity between roads and waters of the state;

   5) Remove perched fill that presents a significant hazard to fish-bearing streams through reconstruction, relocation, or vacating;

   6) The length of time that grant has been submitted and waiting for funding; or

   7) Meet other relevant criteria for prioritization as determined by ODF in consultation with other state and federal agencies.

i. When a grant application has been submitted by an SFO and the Assistance Office has identified that project as a priority, the SFO will collaborate with the Assistance Office and other technical service providers to determine the project specifications, timing of project, hiring of contractors, other project issues, and oversight of the project. The SFO and the Assistance Office may mutually agree on the best and most efficient way to complete the project, under the direction of the Assistance Office. The SFO's involvement in completing the project can vary depending upon the mutual agreement. The actual timing of the project will be determined by contractor availability and other factors. An extension of time may be needed due to factors outside the control of the SFO or ODF.

j. All completed SFISH projects will be annually reported by ODF with cost and miles of streams improved. Funding for SFISH will not interfere with similar programs at the Oregon Watershed Enhancement Board (OWEB), but OWEB participants, such as Watershed Councils and others, may partner with SFOs to coordinate projects funded by SFISH.

5.3.6 Small Forestland Owner (SFO) Assistance Office

a. Creation of Assistance Office within ODF

An SFO Assistance Office will be established by statute, to be housed within the Oregon Department of Forestry. The Assistance Office will provide assistance and coordination for both landowners that meet the criteria for designation as an SFO under section 5.1.2 of this Report, and for other landowners that own or hold in common ownership less than 5,000 acres of forestland in this state.

b. Purpose of the SFO Assistance Office

A primary focus of the Assistance Office will be to implement the financial incentives and technical assistance programs that support the Private Forest Accord and Habitat Conservation Plan.

c. Supporting Services

ODF already supports several programs for owners of small forestlands including the Partnership for Forestry Education, forest management planning, partnership development and program funding, outreach and education through stewardship foresters, and the Committee for Family Forestlands. Existing programs will be housed within the new Assistance Office and will be leveraged to support programs associated with fish passage, barrier removal, road maintenance, and data collection associated with the HCP.

d. Monitoring and Reporting

The Assistance Office will be responsible for building and maintaining a database of SFOs, their ownerships, roads, streams, and other information as determined to be necessary to support compliance with the HCP.

5.3.7 Effectiveness Monitoring

Access to land for the purpose of conducting studies and monitoring shall be encouraged. The AMPC or the IRST (described in Chapter 10) can prepare a report to the Board of Forestry describing instances where access to land has been insufficient to achieve the purposes of this section. If presented with such a report, the Board shall consider rulemaking to address any research and monitoring problems arising from lack of access to land. SFOs that use the SFO Minimum Option or FCC Option, or receive grants for stream crossing or road work, may be required to allow access to land for effectiveness monitoring, specifically tailored to the riparian management or the grants taken, as outlined by AMPC.

5.3.8 Miscellaneous

A. Highly Disproportionate Impacts

The Authors recognize that in some rare circumstance an SFO ownership may become highly encumbered by the new rules in the PFA. This high encumbrance is most likely to be true in ownerships with a dense concentration of streams. The Authors recognize that this change could be especially problematic when the new encumbrances affect an owner of modest means who is highly dependent on revenue from the encumbered locations. In recognition of these more extraordinary cases, the Authors agree to work with ODF and others before full implementation of the rules in 2024 to develop ways to address this encumbrance. Policy options will include consideration of plans for alternate practice based on a forest plan, expanded tax credits, or compensation via grants or other direct payments. The focus will be addressing cases where the encumbrance can be shown to restrict revenue from a location on which the owner is highly dependent for basic income.

B. Natural Flow

The Authors recognize that in some cases impoundments upstream of SFO parcels may create perenniality where none naturally exists, or might alternatively end perenniality where it once existed. Stream typing based on these flows may lead to findings at odds with the natural state of flow. Therefore, the Authors recommend that ODF investigate the extent of this problem and develop methods to correctly classify perennial small non-fish streams on SFO land.

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CHAPTER 6: BEAVER CONSERVATION

6.1 Introduction

The American beaver (*Castor canadensis*) is a keystone species that has played a critical role in shaping landscapes across Oregon and North America. From maintaining wetland and riparian ecosystems to recharging groundwater, beavers can impact multiple biological, physical, and chemical processes. The importance of beavers in Oregon's history is reflected in its status as the official state symbol.

The distribution of the American beaver includes the United States as well as portions of northern Mexico and Canada, stretching from the Atlantic to the Pacific Oceans. Conservative estimates of beaver abundance in North America pre-European settlement suggests approximately 60 million beavers, although estimates as high as 400 million have been made (Seton, 1929). Fur trapping in the 18th and 19th centuries led to rapid declines of beavers across North America. By 1948, an estimated population of only 1.1 million beavers remained in North America (Denney, 1952). With interest in reintroduction of beavers and natural population growth in the 20th century, there was an estimated population of between 9.6 million and 50 million beavers by 2000 (Whitfield et al., 2015).

6.1.1 Impacts of Beaver on Landscapes

Beavers are often referred to as "engineers" because they physically modify their environment through dam, lodge, and canal building (Naiman et al., 1986). These modifications can have significant influence upon other stream- and riparian-dependent species. Beaver dam sites are more commonly found in streams less than 7 meters wide, valley widths greater than 30 meters, and stream gradients from two to four percent (Dittbrenner et al. 2018).

Multiple studies have documented the benefits that beaver dam and pond systems have for salmonid habitat and other wildlife species (Pollock et al., 2003, 2004, 2007, and 2012). The benefits of beaver habitat modification include the following (ODFW, "Living with Beaver"):

- **Pond creation**. Beaver dams protect fish from winter flows and increase water storage, resulting in more stable water supplies and the availability of higher flows over longer periods of time.

  Availability of large woody debris. Beaver dams provide large woody debris that juvenile fish can use to evade predators. They also provide winter pool habitat critical for species such as cutthroat trout and coho.

- **Storage of leaf litter**. Beaver ponds store leaf litter and support aquatic insect production. This acts as an important food source for fish, amphibians, bats, and birds.

- **Nesting and rearing areas for waterfowl**. Beaver dams and ponds support the creation of nesting and brooding habitat for waterfowl. Increased vegetation growth as a result also provides increased forage and cover for wildlife.

- **Wildlife habitat**. Beaver ponds provide habitat for wildlife species including mink, river otter, muskrats, turtles, frogs, and salamanders.

- **Food source for wildlife species**. Rising water levels behind beaver dams may cause trees to die that attract insects and become a food source for wildlife species, such as woodpeckers. Dead and dying tree snags become wildlife habitat for cavity-nesting birds.

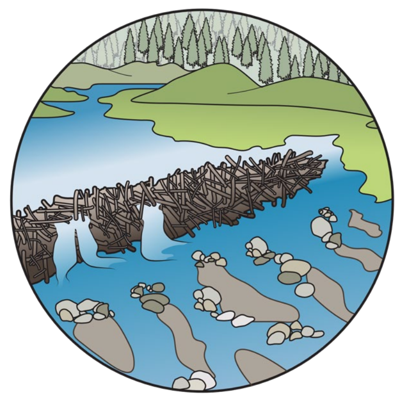
  Aquatic habitat associated with beaver dams is low-velocity, with varying depths, and complex cover. For coho salmon (*Oncorhynchus kisutch*), studies have demonstrated increased juvenile rearing densities,

and growth associated with beaver ponds (Bustard and Narver, 1975; Murphy et al., 1989; Pollock et al., 2004; Malison et al., 2016), increased survival (Quinn and Peterson, 1996), and increased production (Nickelson et al., 1992; Bouwes et al., 2016).

In the Pacific Northwest, beavers are especially important on the landscape in arid regions where they are successful in storing water through deepening stream channels and creating wetlands important for plant and tree communities. Riparian zones established by beavers are more resistant to drought and wildfires (Fairfax and Whittle, 2020). At the local scale, beavers also reduce hydrologic seasonality (Naiman et al., 1988; Baker and Hill, 2003). These impacts have been identified as important to mitigate the effects of climate change on stream ecosystems (Hood and Bayley, 2008).

While natural recolonization of beavers may be a slow process, translocation of beavers is not necessarily successful due to low survival of translocated beavers (Petro et al., 2015). The science pertaining to translocation of beaver is evolving with an increased focus on maintaining the integrity of family units during translocation and pair bonding individual translocated beavers in captivity prior to release. With uncertainty in the success of beaver translocation to date, monitoring and adaptive management will be crucial in evaluating management techniques and philosophies applied to HCP covered forestlands in Oregon.

6.1.2 Beavers and Private Landowners


Elizabeth Morales

Beavers can provide multiple benefits to private landowners, including:

- **Wetland creation to control downstream flooding**. Beaver dams create wetlands that can help to manage downstream flooding by storing and releasing water slowly over time. This reduces the severity of high stream flows, particularly after winter storms and spring snow melt.

- **Improve water quality**. Wetlands that result from beaver dam creation can remove or transform excess nutrients, bind to and remove toxic chemicals, as well as store and filter sediment.

- **Improve groundwater recharge**. By storing water, beaver dams can facilitate groundwater recharge and raise groundwater tables. This can promote vegetation growth, stabilizing stream banks and minimizing erosion.

- **Reduce water velocity**. By storing and releasing water slowly over time, beaver dams reduce water velocity. This reduces stream bank erosion and channel scouring.

- **Wildlife habitat**. Wetlands created by beaver dams provide habitat for fish and wildlife that also provide recreational and aesthetic values for landowners. (ODFW, "Living with Beaver.")

At the same time, beaver activity can also result in conflicts between beavers and private landowners. Beaver activity may result in cutting down trees and shrubs, blocking culverts, and flooding roads and developed areas (Enk et al., 1997; Harbrecht, 1991; Jonker et al., 2006). Efforts to identify and mitigate current and potential conflicts between beavers and private landowners are ongoing (Needham and Morzillo, 2011).

6.1.1 Beavers in Oregon

Although beavers can be found in virtually all of Oregon's waterways, no current population estimate for beavers in Oregon exists (6-12-20 ODFW Staff Presentation to ODFW Commission). However, recent studies have identified abundant unoccupied habitat for beavers. These studies include, but are not limited to:

- Oregon coastal streams using ODFW's Aquatic Habitat Inventory (AHI) to assess recent location of beaver dams and ponds.
- North Fork Burnt River watershed in eastern Oregon using the peer-reviewed Beaver Restoration Assessment Tool (BRAT) to assess existing beaver dam potential.
- John Day Basin in east-central Oregon also using the BRAT to assess existing beaver dam potential.

Under the Oregon Conservation Strategy (OCS), beavers were identified as a key component of the conservation strategies under Goal 2 to maintain and restore floodplain functions. Specifically, the OCS includes Action 2.6 to "support and encourage beaver dam-building activity" (p. 67). The OCS identifies multiple benefits to floodplain functions from beaver dams, including reduced sedimentation, wetland restoration, and improved water quality and habitat for fish. The OCS acknowledges potential conflicts between beavers and landowners and lists strategies to minimize conflicts. Further, ODFW estimates that beaver activity benefits 82 of the 294 (28%) Strategy Species listed in the OCS (see Petition to Initiate Rulemaking to Amend OAR 635-050-0070 to Permanently Closure of Beaver Trapping and Hunting on National Forests, Bureau of Land Management lands, National Monuments, Federal Wildlife Refuges, National Parks, and National Grasslands within the state of Oregon, 2020).

Under current Oregon law, beavers have a dual status. On public lands, beavers are classified as a furbearer (ORS 496.004 and OAR 635-050-0050). On private land, beavers are classified as predatory animals (ORS 610.002). Take of beaver on public land requires a permit while take of beaver on private lands is unregulated.

6.2 Goals

The goals of the PFA regarding beavers are to:

1) Recognize the important role that beavers play in creating habitat for listed salmonids as well as other species;

2) Document the number of beavers taken on private forestlands;

3) Support and allow for the expansion of beaver populations on private forestlands; and

4) Reasonably allow forest landowners to address beaver-related conflicts when they arise.

Specific actions that support the continued expansion of beavers aligned with the goals of this Chapter and the commitments of the PFA include:

1) The prohibition of beaver trapping, except on forestland owned by small forestland owners, under many circumstances, and requiring consultation with the Oregon Department of Fish and Wildlife (ODFW) before trapping under other circumstances;

2) Promotion of reintroduction strategies where landowners are amenable to such actions;

3) ODFW and landowner evaluation of non-lethal measures in circumstances where beavers are creating a risk to infrastructure, prior to resorting to lethal take.

6.3 PFA Commitments

6.3.1 Reporting Requirements

Any person that takes a beaver on privately owned forestland shall report the take to the Oregon Department of Fish and Wildlife (ODFW) to enter into a central database to keep track of the occurrences. The person who commits the take shall report the take, not the landowner who may contract for the removal of the beaver(s).

Reporting requirements include:

a. The name of the person who committed the take of the beaver;
b. The location of the take;
c. The reason for the take;
d. The number of beavers taken; and
e. Other reporting requirements as identified by ODFW

6.3.2 Prioritization of Conflict Resolution and Non-Lethal Removal Methods

Where conflicts exist between private forest landowners and beavers:

a. For a beaver that is causing or may cause damage on privately owned forestland, other than small forestland, ODFW has 30 days to initiate and complete non-lethal removal actions. This may include *in situ* conflict resolution with technical assistance from ODFW to help the landowner resolve conflicts on site. After 30 calendar days, forest landowners, at their discretion, may choose to lethally remove beaver. For purposes of both this provision and the commercial trapping limitation set forth below, “small forestland” means forestland that has an owner that holds or holds common ownership in less than 5,000 acres of forestland in this state.

b. Where a beaver threatens landowner infrastructure (e.g., blocking culverts, etc.), the landowner may 1) destroy the beaver dam; 2) install mitigation devices such as beaver deceivers; or 3) lethally remove the beaver without the advance notification to ODFW discussed in section a. above.

6.3.3 Commercial Trapping Limitations on Select Private Forestlands

Commercial trapping on private forestlands is prohibited, except for on small forestland. Beaver trapping on private forestlands, other than small forestlands, must be for personal use only. No sale or trade of beaver trapped on private forestlands, other than small forestlands, is allowed.

6.3.4 Beaver Research in Adaptive Management

Beaver research shall be incorporated into the adaptive management framework established in Chapter 10. This approach will be used to provide science-based recommendations and technical information to the Board in determining if and when it is necessary or advisable to adjust rules, guidance, and training programs to achieve resource goals and objectives identified in the Habitat Conservation Plan (HCP).

6.3.5 Establish Voluntary Beaver Relocation Program for Private Forestlands

ODFW will establish a voluntary beaver relocation program for private forestlands. This program should include:

a. Promotion of beavers as an important tool for habitat restoration and recovery of listed species;

b. Promotion of non-lethal beaver management strategies; and

c. Development of a list of private forest owners willing to receive relocated beavers.

6.4 Revised Rules in Conformance with PFA Commitments

Rules associated with wildlife management need to be included in the Wildlife Title 41, Chapter 458 where trapping laws are specified. Requirement of reporting and tracking incidences of lethal take may require revision.

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CHAPTER 7: AMPHIBIAN CONSERVATION

7.1 Introduction

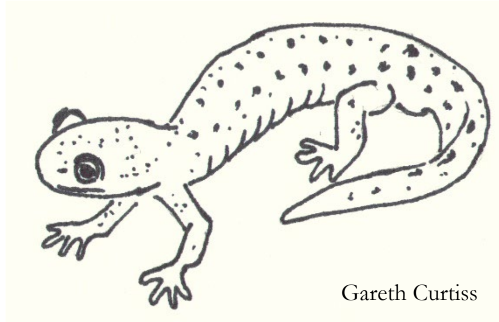
The Authors were able to reach agreement regarding protections for five stream-dwelling amphibian species sufficient to support coverage under a Habitat Conservation Plan (HCP). These species are: Columbia torrent salamander (*Rhyacotriton kezeri*), Southern torrent salamander (*Rhyacotriton variegatus*), Coastal giant salamander (*Dicamptodon tenebrosus*), Cope's giant salamander (*Dicamptodon copei*), and Coastal tailed frog (*Ascaphus truei*). In Western Oregon forests, these species are stream-obligates during early development (eggs and larvae). Upon metamorphosis, they can occur in or along streams and use riparian and upland forests for foraging, dispersal, overwintering and aestivation. However, in some cases, mature life forms of giant salamanders remain in streams for their entire lives ("neoteny").

At the time of the PFA agreements, these species had the following status:

- Columbia torrent salamander: Under review for listing under Federal Endangered Species Act, Oregon Sensitive, ORBIC 4, IUCN near threatened;
- Southern torrent salamander: Oregon Sensitive, ORBIC 4;

- Coastal giant salamander: No special status designations;
- Cope's giant salamander: Oregon Sensitive, Special Status/Sensitive Species; ORBIC 2 (Imperiled); and
- Coastal tailed frog: Oregon Sensitive, ORBIC 4.

The Authors considered issues related to riparian buffers, connectivity, roads, culverts, and water quality and temperature that informed the approach of this Chapter. The Authors also considered other approaches to protection of stream-dwelling amphibians, including the draft Western Oregon Forest Habitat Conservation Plan and the Washington Forest Practices Habitat Conservation Plan. This Chapter is not intended to be a comprehensive literature review of the variable response of amphibians to disturbance.


Gareth Curtiss

At watershed scales, stream-dwelling amphibian habitat includes streams that occur higher up in the stream network than federally protected fish species and therefore, protections and management approaches focused on fish are not necessarily sufficient to protect stream-dwelling amphibians. Coastal giant salamanders and Coastal tailed frogs can co-occur in reaches with fish, but the entire assembly of stream-dwelling amphibians also frequently relies on non-fish-bearing headwater streams. As a result, specific strategies to avoid, minimize, or mitigate impacts to stream-dwelling amphibians are largely absent under the current Oregon Forest Practices Act and related regulations.

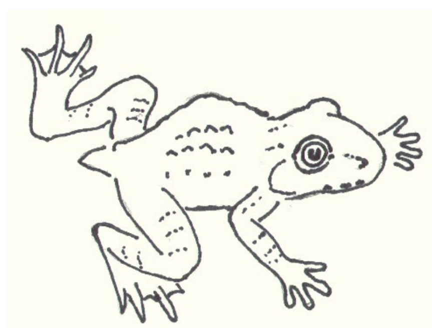
Stream habitat for tailed frogs, torrent salamanders, and giant salamanders includes cool, clear surface water flow with instream microhabitat complexity, such as coarse stream substrates with interstitial spaces. Yet, the heterogeneity of small headwater streams warrants recognition relative to these species' occurrences. More specifically, Coastal tailed frogs and Coastal giant salamanders are more often associated with perennial stream reaches with larger substrates and more down wood, and torrent salamanders have been found in smaller waters with smaller substrates, less down wood, and spatially intermittent streamflow patterns (Olson and Weaver, 2007; Thompson et al., 2018). After larval metamorphosis, many stream-breeding amphibians also are found within upland forests and have been trapped to 400 meters upslope of streams (Olson et al., 2007). The Authors have differing opinions regarding the conclusion that genetic analyses documented broader landscape-scale dispersal patterns in the following studies (Coastal tailed frog recolonization of Mount St. Helens post-eruption: Spear et al., 2012; torrent salamanders in the Oregon Coast Range: Emel et al., 2019).

Stream-dwelling amphibians are also found within upland forests of the Pacific Northwest, with older-forest associations of these species supporting risks of historical forest management practices (Blaustein et al., 1995). For example, Pollett et al. (2010) found Coastal tailed frog and Cascade torrent salamander densities were 2-7 times lower in streams within managed forests than in streams in unharvested forests.

There is often variability in responses of stream-dwelling amphibians to disturbance. Existing uncertainties around responses of stream-dwelling amphibians to the collective disturbances associated with forest management prescriptions in Oregon is confounded by the variability in the contexts of individual studies, including a lack of studies that explicitly test contemporary treatments while controlling for high variability in landscape and site conditions (Schmidt and Garroway, 2021; Martin et al., 2021). Martin et al. (2021) evaluated the relationship between riparian buffering regimes, stream temperatures, and stream-associated amphibians and found no evidence to support that abundance of amphibian populations are positively correlated with larger buffers.

Due to the late publication of Olson and Ares (2022) during the course of the negotiations, not all of the Authors were able to review and evaluate this work. In a western Oregon study initiated in 1994 with a before-after-control-impact design across 8 sites and 54 stream reaches, Olson and Ares (2022) reported support for decadal lag-time effects on stream amphibians of buffer widths with upland thinning. Both Coastal giant salamanders and torrent salamanders were found in higher densities in streams with a one potential-tree height riparian buffer compared to narrower buffers, and torrent salamanders had associations with streams in unthinned control units as well.

In a western Oregon study, Olson and Burton (2014) reported reduced densities of *Rhyacotriton spp.* in stream reaches with the narrowest buffer they examined (6 m wide on each side of streams) with two sequential entries of upland secondary-forest thinning. The Authors have differing opinions on the conclusion that the data in this study supported the use of the wider buffers that they examined in their study, a minimum of 15 m wide on each side of streams, to retain sensitive headwater stream amphibians.


Gareth Curtiss

In a second comprehensive before-after-control-impact (BACI) study of riparian buffers in hard rock lithology in western Washington, McIntyre et al. (2021) found riparian buffers adjacent to non-fish-bearing perennial stream buffers of second growth timber were important for tailed frogs, but no demographic effects were found for torrent and giant salamanders. This study emphasizes the importance of reviewing changes to salamander populations over an extended time period, as impacts may not manifest in the years immediately following harvest. However, when genetic analysis was applied over the same time period, evidence was not found for any population level effects for Coastal tailed frogs or any amphibian species following the harvest prescriptions (Spear et al., 2019). Though interpretations of these results differ, these results support the fact that there is often variability in responses of amphibians to disturbance (Schmidt and Garroway, 2021) and the different response parameters and their time elements may warrant consideration.

The uncertainties surrounding amphibian population characteristics, distribution, productivity, survival, and abundance, as well as the variable response of amphibians to disturbance informed the approach of the Authors established in this Report. These uncertainties underpin the decision to prioritize research under the adaptive management process to ensure that the efficacy of protection strategies will be evaluated and adjusted as needed in a timely manner.

7.2 Goals

The goal of riparian management practices and other conservation measures described in this section is to protect and conserve stream and riparian habitats important for all life stages of Columbia (*Rhyacotriton kezeri*) and Southern (*R. variegatus*) torrent salamanders, Coastal *(Dicamptodon tenebrosus)* and Cope's *(Dicamptodon copei)* giant salamanders, and Coastal tailed frog (*Ascaphus truei*).

7.3 PFA Commitments

7.3.1 25-Year Term for Coverage of Amphibians Under HCP

The Authors agree to support a 25-year term for coverage for the following stream dwelling amphibians under a Habitat Conservation Plan (HCP):

- Columbia torrent salamander (*Rhyacotriton kezeri*)
- Southern torrent salamander (*Rhyacotriton variegatus*)
- Coastal giant salamander (*Dicamptodon tenebrosus*)
- Cope's giant salamander (*Dicamptodon copei*)
- Coastal tailed frog (*Ascaphus truei*)

7.3.2 No Agreement on Cascade Torrent Salamander

This agreement will not cover Cascade torrent salamander (*Rhyacotriton cascadae*).

7.3.3 Conservation Measures to Support Protection of Stream-Dwelling Amphibians

Conservation measures to support the protection of stream-dwelling amphibians include riparian prescriptions that protect fish and non-fish-bearing streams as identified in Chapter 2 of this Report. That Chapter includes conservation measures for seasonal and perennial streams that provide important habitats for stream-dwelling amphibians. Additional protections for seeps, springs, and stream-associated wetlands are established in Chapter 2.
Additional conservation measures to conserve stream-dwelling amphibians include:

a. The Slope Retention Areas, Designated Debris-Flow Traversal Areas, and Stream Adjacent Failure prescriptions which are identified in Chapter 3.
b. The wetland protections, including the 2:1 replacement for filling or draining wetlands, identified in Chapter 4.
c. The updated culvert design standards identified in Chapter 4.
d. The reduction of fine sediment through the hydrologic disconnection of roadside conveyance systems from streams as identified in Chapter 4.

7.3.4 Adaptive Management

Uncertainty exists around amphibian population characteristics, distribution, productivity, survival, and abundance. A robust effectiveness monitoring plan as part of an adaptive management program will be used to better understand the relationship between forest management and covered amphibian species. To support this program, it is recommended that $1.5 million be initially applied to research through the first funding cycle of the adaptive management program to better understand how riparian and unstable slope protections of at least the current and proposed rules for private forestland impact persistence of populations. The Authors agree that the $1.5 million will be used to fund an initial study and that ongoing research over appropriate intervals of time beyond this initial study will be necessary to understand research outcomes over long periods of time. The priority species for monitoring will be the Columbia and Southern torrent salamanders. With consideration to funding constraints and other priorities, this research could also include other species covered by the HCP. Additionally, it could include Cascade torrent salamanders, which are not covered by the HCP.

7.4 Revised Rules in Conformance with PFA Commitments

The conservation measures summarized in Section 8.3.3 will be promulgated into rule consistent with those Chapters.

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CHAPTER 8: COMPLIANCE MONITORING

8.1 Introduction

A compliance monitoring program (CMP) is fundamental to understanding whether forest practice rules identified in the Habitat Conservation Plan (HCP) are correctly implemented. Comprehensive compliance monitoring is robust and provides information without systematic bias and with sufficient precision to be representative of forest practice activities. A successful CMP provides information as a foundational element in improving training protocols, enhancing public trust in forest practices implementation, and ensuring forest operators are following the rules.

8.2 Goals

The following goals are established for compliance monitoring:

a. Compliance monitoring assesses whether the rule groups identified in the HCP and the broader Forest Practices Act and rules are being implemented as intended. The CMP provides feedback to the Oregon Department of Forestry (ODF), the federal services, and stakeholders to aid in targeting specific areas for guidance, training, clarification, and/or enforcement.

b. The CMP should provide an objective assessment of rule compliance. The CMP does not report on the effectiveness of the rules.

c. The infrastructure to support the CMP will include adequate compliance monitoring, enforcement, training, education, and budget.

8.2.1 Objectives

Aligned with the established goals for compliance monitoring, the following objectives are developed for compliance monitoring:

a. Verify compliance with the rule groups identified in the HCP.

b. Provide an informed and systematic basis for targeted training efforts to increase compliance with Forest Practices Act and rules.

c. Improve compliance with the HCP and broader Forest Practices Act and rules.

d. Provide data that can be used in reporting, including to the Board of Forestry (Board), the Oregon Legislature, and the federal services under the terms of an HCP.

The Authors expect that as these objectives are met, the public's trust in the implementation of Forest Practices Act and rules will improve.

8.3 Private Forest Accord Commitments

8.3.1 Process for Compliance Monitoring Program (CMP)

In order to develop a compliance monitoring program (CMP) aligned with the above goals and objectives, the Authors established the following process:

a. Every two years, ODF should conduct a statistically sound, biennial compliance and performance audit and prepare a report to the Board.

b. In addition, compliance monitoring data will support other ODF reporting requirements, including the following:

    i. An annual report to the public on overall HCP performance;

    ii. Rolled up, cumulative reports every 8 years; and

    iii. Other reports as required by the terms of the HCP.

c. The CMP process should:

    i. Be informed by the recommendations of the "Oregon Forest Practices Act Implementation Study: History, Issues, and Potential Solutions" final report prepared by Mount Hood Environmental and submitted to the Board on June 15, 2021, and similar reviews of other compliance monitoring programs in nearby states (e.g., Washington and Idaho).

ii. Explicitly define all sampling elements.

iii. Utilize remote sensing or modifications to the FERNS notification system to identify completed activities.

iv. Accommodate ODF, cooperating state agencies, or contractor access to land for purposes of assessing compliance with Forest Practices Act and rules.

v. Analyze compliance rates at the appropriate temporal and spatial scale to reduce autocorrelation, variance, and systematic bias that has impacted monitoring programs across the Pacific Northwest. Continue to pursue ODF's Key Performance Metrics, however defined, with an initial target of 95% compliance at the 8-year roll-up report.

vi. The Board can direct the CMP to conduct analysis at the rule and unit level as appropriate to determine levels of compliance.

vii. When identified, examine areas of noncompliance to determine if they represent a specific set of circumstances or if they are a systemic response that might warrant new training, guidance, rule clarification, or other appropriate action.

viii. Produce a roll-up report every 8 years that includes compliance trends since the beginning of the CMP.

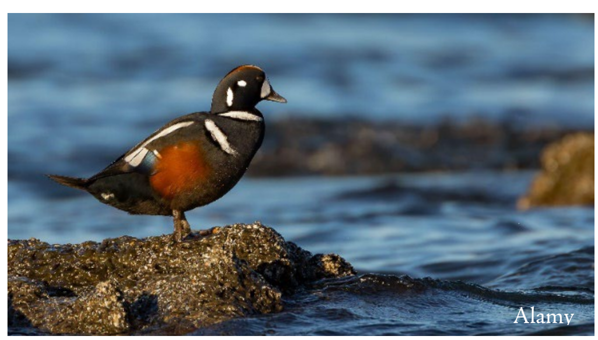
d. ODF has discretion to identify additional rules for review according to this process.

8.3.2 Outcomes for Compliance Monitoring Program (CMP)

The Authors establish the following outcomes for the compliance monitoring program (CMP):

a. Reporting on the implementation of HCP-identified forest practice rules on the ground.

b. Identify opportunities to improve compliance as needed through education for landowners, regulators, consultants, and operators as suggested by non-compliance rates.



c. Provide information that revises rules and technical guidance, when appropriate.

d. Provide the biannual and 8-year reports to the federal services assessing compliance with the HCP.

8.3.3 Administration of Compliance Monitoring Program (CMP)

The Authors establish the following process for administration of the compliance monitoring program (CMP):

a. The CMP administration is led by ODF personnel. Specific monitoring field work can be conducted by ODF personnel, through hired contractors, or some mix of both.

b. ODF should hire an external, qualified statistician to aid in developing sample selection and evaluation criteria to ensure a high level of confidence in the statistical modeling and final reported compliance numbers.

c. The CMP is supported by a stakeholder group comprised of representatives that have expertise in the purpose for and implementation of the rules that are being monitored, including but not limited to agency staff, landowners, and operators.

d. Funding needs for the CMP will be influenced by the number of rules evaluated, acceptable statistical precision, and frequency of reporting.

8.4 Revised Rules in Conformance with Private Forest Accord Commitments

The Authors identified the following activities and rules to review for conformance with the goals, objectives, and Private Forest Accord commitments described above. The compliance monitoring program (CMP) must, at a minimum, assist in the monitoring of rule implementation related to rule groups identified in the HCP. The following rule groups should be prioritized in the CMP:

a. Riparian rules that are required to be established under Chapter 2 of this Report.

b. Steep slope rules that are required to be established under Chapter 3 of this Report.

c. Road rules that are required to be established under Chapter 4 of this Report.

d. In addition to the rule groups outlined above, other rules may be evaluated in the CMP according to the process identified in Section 8.3.1.

CHAPTER 9: ENFORCEMENT

9.1 Introduction

Enforcement of the Forest Practices Act and rules is necessary to ensure the integrity of the regulatory framework. Currently, ODF lacks staffing and statutory authority to adequately enforce laws and rules. Education for landowners and operators should be a foundational component of any enforcement program with financial penalties and stop work orders focused on egregious violations and repeat violators.

9.2 Goals

The Authors establish the following goals for enforcement:

a. Ensure that rules are being followed.

b. Improve training and the clarity of technical guidance so that implementation expectations are transparent and easily understood by landowners and operators.

c. Provide confidence to the public that the Forest Practices Act and rules are being followed.

9.2.1 Objectives

Aligned with the established goals for enforcement, the Authors establish the following objectives:

a. Utilize the enforcement process as an educational tool and a training opportunity.

b. Focus penalties on egregious violations and repeat violators.

c. Ensure that the enforcement process deters future violations.

Gareth Curtiss

9.3 Private Forest Accord Commitments

9.3.1 Process for Enforcement

In order to develop a framework for enforcement aligned with the goals and objectives stated above, the Authors establish the following enforcement process:

a. ODF will establish a mechanism to determine the underlying cause of the violation, including to determine whether the infraction could have been avoided by:

i. More explicit training on rule implementation.

ii. Rule clarification or improvement in language.

iii. Additional communication efforts for specific site conditions.

b. ODF will retain its existing statutory powers to enforce the Forest Practices Act within the following framework:

i. Written Statements of Unsatisfactory Condition should continue to be used as a communications and corrective tool in instances where resource damage has not occurred, can be corrected, or is minor.

ii. Civil penalties, orders prohibiting new operations, and criminal prosecution should focus on repeat violators; landowners and operators who fail to comply with corrective actions and/or pay penalties; and landowners and operators who willfully violate rules or statutes.

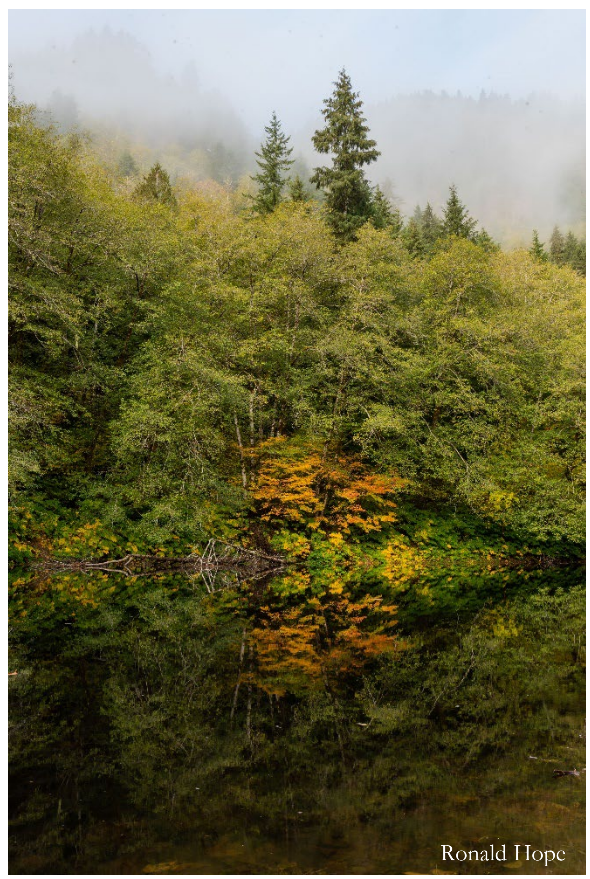
c. **Repeat Violators** – Recognizing that current enforcement actions tend to accumulate among repeat violators, ODF should focus its resources and attention on this set of landowners or operators (e.g., after training, rule clarification, and communication efforts have been attempted, as applicable).

i. A Repeat Violator is a landowner or operator with a history of significant violations that, taken together, show a pattern of ignoring the rules or the Forest Practices Act. In evaluating a landowner's or operator's history of significant violations, ODF should take into account company organization, the proportion of total operations that are in violation compared to the total number of operations conducted, and the degree, if any, to which the landowner or operator derived significant economic benefit from the significant violation.

ii. "Significant violations" means operating without providing proper notification of a forest practices activity (other than an unintentional operation outside of an approved boundary of such notification), the continuation of operations in breach of the terms of an ODF citation and order, or resource damage that is major in effect and self-restoration takes more than 10 years.

iii. ODF should maintain a list of Repeat Violators. The rule implementing this section must include a process and criteria for removing a Repeat Violator from the list.

d. **Penalties** – During the PFA process, various concerns about the adequacy of penalties to deter noncompliance for deliberate violators were raised. To ensure that penalties have adequate deterrent effect, the Authors agree on various penalty amounts that have been included in the PFA authorizing legislation.


Ronald Hope

e. **Tracking** – ODF should ensure that its process for tracking operators and landowners that change name and location is sound.

f. **Remote Sensing and Notification of Completion of a Forest Practice** – The Forest Practice Rules in effect as of the date of this Report require landowners and operators to notify ODF of plans to execute any forest practice activity. To aid in compliance monitoring and enforcement, ODF should do one of the following:

i. Require notification of completed forest practice activities within a reasonable timeframe of completion. Notification of completed activities could apply only to a subset of activity types that ODF is most concerned with tracking;

ii. Use remote sensing to identify landowners who have completed forest practice activities to prioritize agency personnel time; or

iii. Otherwise develop a program that determined when operations for which notifications have been filed have been conducted.

g. **Access to land** – Amendments to state law will be necessary to explicitly allow ODF, cooperating state agencies, or contractor access to land for the purpose of enforcing the Forest Practices Act and rules when a forest practice notification is active and some period thereafter not to exceed three years.

9.3.2 Enforcement Program Administration

The Authors support the establishment of the following process for administration of the enforcement program:

a. Staffing at ODF to support enforcement and training may need to be increased. To adequately administer the program, ODF needs:

i. 1.0 FTE additional Civil Penalties Administrator to ease the workload and backlog for the current administrator.

ii. 1.0 FTE FPA Coordinator to be specifically dedicated to enforcement, support Stewardship Foresters in the field with enforcement issues, and act as a liaison between Stewardship Foresters and the Civil Penalties Administration office.

iii. 1.0 FTE in new training staffing. Training staffing will support internal staff (i.e., Stewardship Foresters) and external stakeholders in understanding the forest practices act and rules.

b. Stewardship Foresters will continue to be an essential element in the Enforcement Program by working to better understand compliance and ways to reduce infractions.

9.4 Revised Rules in Conformance with Private Forest Accord Commitments

The activities and rules identified in this Report will be reviewed for conformance with the goals, objectives, and Private Forest Accord commitments described in this Chapter. The enforcement program must, at a minimum, assist in the monitoring of rule implementation related to rule groups identified in the HCP.

CHAPTER 10: ADAPTIVE MANAGEMENT FRAMEWORK

10.1 Introduction

The National Research Council (2004) defines adaptive management as "flexible decision making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood. Careful monitoring of these outcomes both advances scientific understanding and helps adjust policies or operations as part of an iterative learning process."

The Authors support establishment of an adaptive management framework to provide science and technical information to support Board of Forestry decisions when needed to adapt rules, guidance, and training programs to achieve the resource goals and objectives identified in the Habitat Conservation Plan (HCP).

The adaptive management program will be driven by two primary questions:

1. **Effectiveness Monitoring:** Do the rules facilitating particular forest conditions and ecological processes achieve program goals and resource objectives?

2. **Research Inquiry and Validation Monitoring:** Are the resource objectives the correct ones to achieve overall program goals? What additional scientific inquiry is needed to fill in knowledge gaps that can add or prioritize resource objectives that will aid in achieving overall program goals?

Effectiveness monitoring seeks to determine if existing rules are meeting program goals and resource objectives. Studies to determine effectiveness will be most readily accomplishable when the causal link or links between a certain forest practice and its impact on the resource is well-documented. While the feedback loop should be responsive and efficient, research data and sample size will need to be adequate to determine the need for rule or guidance change. Research may test whether less operationally expensive alternative prescriptions can effectively meet resource objectives and may evaluate whether more conservative prescriptions are necessary.

Research inquiry and validation monitoring seek to better understand the relationship between certain forest practices and their impact on resources. Validation monitoring is especially useful when goals and objectives are based upon hypotheses that have not received adequate testing. Careful evaluation in these instances is important to improve the monitoring program and provide feedback and appropriate context for decision making. Research inquiry and validation monitoring can highlight emerging areas of emphasis in the forest practices realm and may improve understanding of whether and to what extent causal links exist between forest practices and observed impacts on resources. Results from studies will need time to be verified and for any implications to be understood. The feedback loop for research inquiry and validation monitoring will evolve more deliberately as new findings build on one another. Changes to rule or guidance that result from this segment of adaptive management will require clear documentation and rigor.

10.2 Goals

The purpose of the effectiveness monitoring program and adaptive management framework developed by the Authors is to provide science-based recommendations and technical information to assist the Board in determining if and when it is necessary or advisable to adjust rules, guidance, and training programs to achieve resource goals and objectives identified in the Habitat Conservation Plan (HCP). The Board may also use this program to adjust other rules, guidance, and training programs.

Within 6 months following the completion of this Report, the Authors in consultation with the Oregon Department of Forestry, Oregon Department of Fish and Wildlife, Oregon Department of Environmental Quality and other agencies as appropriate will define resource objectives that will enable attainment of the Goals of this Chapter and the PFA Report that will support an approvable HCP, consistent with the requirements of the Endangered Species Act.

10.2.1 Desired Outcomes for Adaptive Management Program

The Authors establish four desired outcomes for the adaptive management program:

1. Ensure timely and effective change as needed to meet resource objectives;
2. Predictability and stability of the process of changing regulations so that landowners, regulators, and interested members of the public can understand and anticipate change;
3. Application of best available science to decision-making; and
4. Effectively meeting resource objectives with less operationally expensive prescriptions when feasible.

10.3 Private Forest Accord Commitments

10.3.1 Adaptive Management Program Structure

Oregon's adaptive management program will rely on an Adaptive Management Program Committee (AMPC) and an Independent Research and Science Team (IRST).

Gareth Curtiss

10.3.1.1 Adaptive Management Program Committee (AMPC)

The AMPC will fulfill the following primary roles:

a. Set the research agenda, including priorities, for the IRST and guide the overall adaptive management process; prepare a budget for the IRST for Board consideration and approval;

b. Assess the scientific outcomes reported by the IRST and prepare a report for the Board that identifies alternatives (including no action) that could address identified problems;

c. Help the Board in the ongoing process of identifying and modifying resource objectives; and

d. Review CMP and enforcement reports and prepare any recommendations to the Board for rule adjustment, guidance, or training.

The AMPC will set the scientific agenda, but will play no part in designing actual research projects, carrying out the inquiry, or the IRST's report of findings to the Board and AMPC. The AMPC sets the research agenda for the IRST, assesses scientific outcomes reported by the IRST, and prepares reports to the Board regarding rule adjustment, guidance, or training. As directed by the AMPC, the IRST conducts scientific inquiry, including but not limited to literature reviews and original research, and also prepares reports to the Board.

The AMPC will consist of 10 voting members and up to three non-voting members. The Board shall select as a voting member one representative from each of the following interest areas nominated by stakeholder caucuses:

- Industrial forest landowner community nominated by the Oregon Forest and Industries Council
- A timber operator nominated by the Associated Oregon Loggers
- Small forestland owner community nominated by the Oregon Small Woodlands Association
- Conservation landowner (i.e., land trust) nominated by the Coalition of Oregon Land Trusts
- Tribal representative nominated by the Legislative Commission on Indian Services
- Conservation community, representative collectively nominated by Beyond Toxics, Cascadia Wildlands, Klamath Siskiyou Wildlands Center, Oregon League of Conservation Voters, Oregon Stream Protection Coalition, Oregon Wild, Portland Audubon, and Umpqua Watersheds
- Commercial or recreational angling community, representative collectively nominated by Northwest Guides and Anglers Association, Pacific Coast Federation of Fishermen's Associations, Trout Unlimited and Wild Salmon Center
- County government nominated by the Association of Oregon Counties
- Oregon Department of Forestry (ex officio)
- Oregon Department of Fish and Wildlife
- Oregon Department of Environmental Quality
- NOAA Fisheries (ex officio)
- USFWS (ex officio)

Committee members shall serve four-year terms, and may serve an unlimited number of terms. The State Board of Forestry shall appoint the first voting members of the Adaptive Management Program Committee on or before November 30, 2022. Of those appointed in 2022, two shall serve for terms ending one year after the date of appointment, two shall serve for two years after date of appointment, and three shall serve for terms ending three years after date of appointment. The remaining three 2022 appointees shall serve full four-year terms.


Wild Salmon Center

The AMPC will be led by a program administrator. This position will be a neutral facilitator whose primary program function is to assist forward progress in a timely manner by engaging communication among program entities; ensuring responsiveness from participants at the AMPC and IRST; and providing the Board with an annual report about program budgets and schedule.

10.3.1.2 Independent Research Science Team (IRST)

The IRST will be tasked with, and adequately funded to oversee, the research projects that the AMPC prioritizes and delineates. The IRST may be, but need not be, housed at a state agency or an independent research university.
The makeup of the IRST will be determined by the Board based on an evaluation of qualifications and recommendation by the AMPC to establish membership in the IRST. The IRST will be required to set up its own operating protocols emphasizing peer-review of findings, testable hypotheses, and reporting back to the AMPC and Board in lay terms that aids in the applicability of the science to questions of rule changes.

Morgan Heim

The IRST may conduct their inquiry through literature review, field monitoring, original research, commissioned studies, and other means of scientific inquiry. When reporting out findings to the Board and AMPC, the IRST should include, as applicable, the following:

- Methods sufficient to allow others to understand what was done and to evaluate the results and conclusions

- Detailed description of the results
- Discussion and conclusions about:
  - **Effectiveness:** In studies examining alternative prescriptions, the likely effectiveness of each will be reported
  - **Causal links:** Assess how the results of relevant new research findings developed by the IRST or through outside research clarify or support causal links between forest practices and aquatic resources, and implications with regard to how well forest practices rules or rule sets are likely to address these linkages.
  - **Magnitude of impact**: Assess the magnitude of impact on covered species or resource objectives on a sliding scale (e.g., Very High, High, Modest, Low, Very Low).
  - **Urgency of action needed:** Assess the urgency of action needed.
  - **Scientific uncertainty versus confidence:** Assess scientific uncertainty versus confidence.

Reports from the IRST will be submitted to the Board for consideration along with a report on alternative options for possible rule changes from the AMPC.

IRST members will serve four-year terms that can be extended as described below. After the initial selection of IRST members by the AMPC and the Board, all new members and the approval of extended terms for existing members will be voted on by the existing IRST members. IRST members can be removed before the end of a term by a super majority (two-thirds vote) of IRST peers or by a vote of the Board. New IRST members (either to fill a vacancy or to add a new scientific or technical discipline) will be appointed by the Board from a list of candidates submitted by the team.

IRST members must have adequate qualifications to serve on the IRST. These qualifications include demonstrated subject matter expertise in a relevant field and a graduate-level degree in a relevant natural resources-related field such as forestry, silviculture, ecology, hydrology, wildlife, fisheries, and geology.

The IRST, and any subcommittees it forms, will include a representative employed or contracted by one of each of the following: a public institution, a public interest non-governmental organization that promotes conservation of freshwater aquatic habitat, and the timber industry.

10.3.2 Adaptive Management Program Decision-Making Structure

Scientific inquiry aimed at understanding complex ecological relationships takes time to produce results in part because of frequent time lags in the ecological responses. Thoughtful, evidenced-based decision making is critical to ensuring stability of forest practice rules over time. However, the adaptive management process must be rigorous, not calcified.

10.3.2.1 Consensus Continuum Model

Oregon's adaptive management process should pursue a decision-making framework that uses alternatives to full consensus. The consensus continuum model aims for full consensus at steps along the decision-making path and allows stalemates to be broken by supermajority (two-thirds) votes.

A consensus continuum model would be applied at the AMPC level where the multi-stakeholder nature of the committee may be ripe for stalemate. The consensus continuum approach will apply to decisions related to designing research agendas, setting budgets, and finalizing reports to the Board. The consensus continuum approach explicitly leaves open the ability for any stakeholder on the AMPC to put forward a minority report to the Board.

Fixed timeframes will be developed for all AMPC and IRST process stages. While all parties agree that striving for a consensus solution can provide for a more enduring regulatory system and help forge a cooperative change management process, fixed timeframes need to be established for all process stages to avoid procedural delays in the decision-making process.

10.3.3 Aquatic Rulemaking and Non-Aquatic Rulemaking

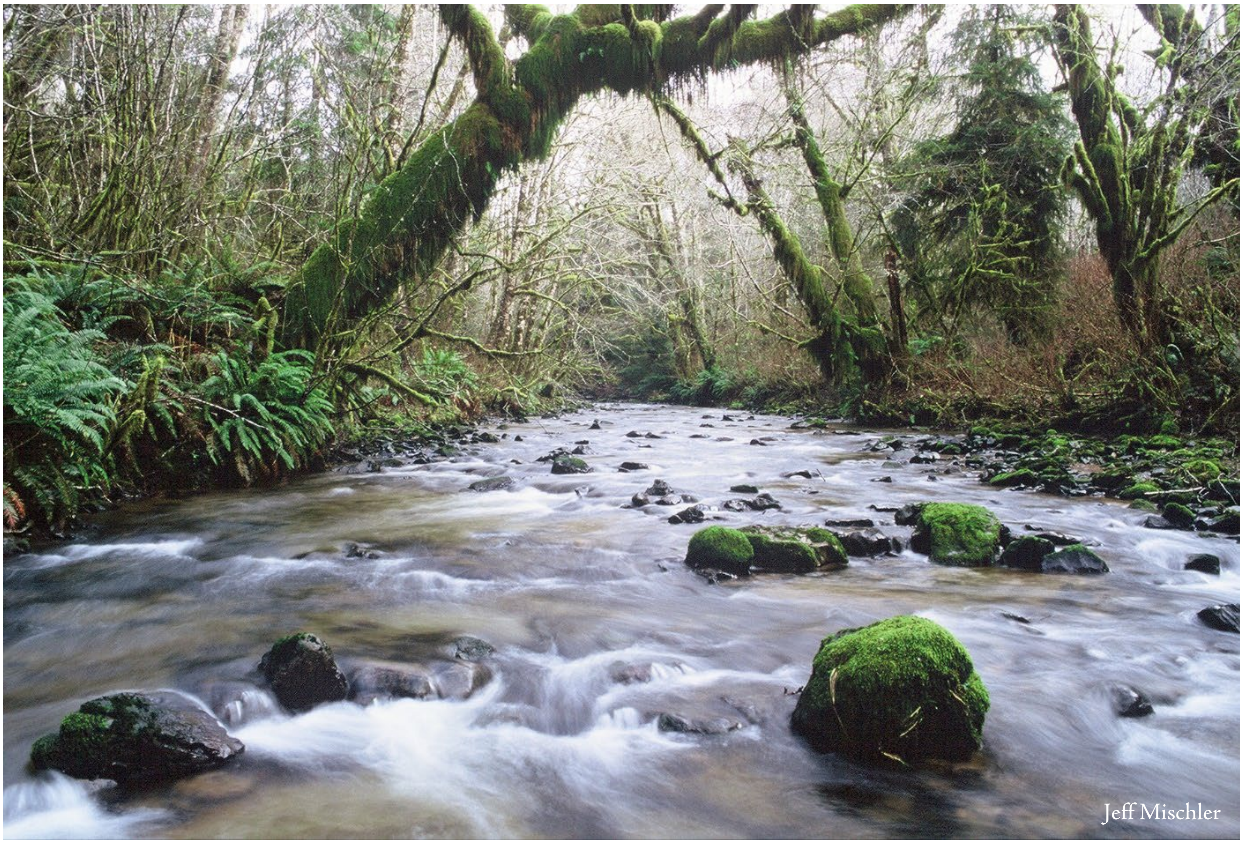
The Board is required to use the adaptive management process for all aquatic-related (HCP-covered) species issues, other than those that are the result of a petition by the Environmental Quality Commission under ORS 527.765(3)(e). For such an EQC petition, the Board may, but is not required to, use the adaptive management process. If it chooses to use the adaptive management process for an EQC petition, the 2-year timeline for completing that work must either be met or extended as provided in ORS 527.765(3)(e). The Board can also choose to use the adaptive management process for other issues. The Board must ensure that the use of the adaptive management process for non-aquatic issues does not impair the ability of the program to provide the required elements of the incidental take permit. If the Board directs the AMPC and the IRST to address non-aquatic issues, the IRST should consult with experts in that non-aquatic issue area to support IRST projects and reports.

10.3.4 Access to Land

Access to land for the purpose of conducting studies and monitoring contemplated by this section shall be encouraged. The AMPC or the IRST can prepare a report to the Board describing instances where access to land has been insufficient to achieve the purposes of this section. If presented with such a report, the Board shall consider rulemaking to address any research and monitoring problems arising from lack of access to land. Small forestland owners that take advantage of alternative minimum practices or financial incentives from the state shall be required to allow access to land for effectiveness monitoring specific to the alternative minimum practices used or the financial incentives received from the state.

10.4 Literature Cited

National Research Council, 2004. Adaptive Management for Water Resources Planning. The National Academies Press, Washington



CHAPTER 11: MITIGATION

11.1 Introduction

The Habitat Conservation Plan (HCP) Handbook developed by the U.S. Fish and Wildlife Service (USFWS) and NOAA Fisheries (2016) defines "mitigation" as "avoiding, minimizing, rectifying, reducing over time, and compensating for impacts on natural resources" applied sequentially with compensatory measures considered after all "appropriate and practicable" avoidance and minimization measures have first been considered (p. 9-3). The HCP Handbook provides that "[m]itigation measures in the HCP must be based on the biological needs of covered species and should be designed to offset the impacts of the take from the covered activities to the maximum extent practicable" (p. 9-14).

The HCP Handbook goes on to suggest seven major categories of mitigation measures:

1. Restoration of degraded habitat to natural condition/function, or to a condition likely to be resilient to projected changes.

2. Land preservation.

3. Enhancement of habitat.

4. Creation of new habitat or new populations.

5. Threat reduction or elimination.

6. Translocation of affected individuals or family groups to establish new or augment existing populations.

7. Repatriation of species to formerly occupied and still suitable or enhanced habitat.

11.2 Goals

Aligned with the HCP Handbook, the Authors acknowledge that mitigation measures for the purposes of the PFA must be based on the biological needs of the Covered Species. To the maximum extent practicable, mitigation measures must be designed to offset the impacts of the take of covered species from the Covered Activities.

11.3 Private Forest Accord Commitments

For purposes of the PFA, mitigation efforts will focus on items 1, 2, 3, and 5 of the major categories of mitigation measures identified in the HCP Handbook:

- Category 1: Restoration of degraded habitat to natural condition/function, or to a condition likely to be resilient to projected changes.
- Category 2: Land preservation.
- Category 3: Enhancement of habitat.
- Category 5: Threat reduction or elimination.

11.3.1 Mitigation Efforts for the Purposes of the PFA

Mitigation efforts for the purposes of the PFA will include the following practices described below, and such other measures that effectively conserve or restore habitat for aquatic organisms covered by the habitat conservation plan issued pursuant to this Report.

11.3.1.1 Restoration or Enhancement

The HCP Handbook states that "restoration is focused on returning habitat to its natural or historic state." This may include re-establishing a former resource or improving a degraded resource to a natural or historic structure and function (HCP Handbook, p. 9-15). Habitat enhancement often "involves manipulation of the physical, chemical, or biological characteristics of a resource" with the goal of increasing or improving specific habitat functions (HCP Handbook, p. 9-17).

The Authors identified the following mitigation efforts related to restoration or enhancement for the purposes of the PFA:

a. **Aquatic organism passage:** Habitat connectivity is often reduced or eliminated when structures are placed instream or in-stream-adjacent wetlands. These structures frequently include culverts associated with road development, or dams and tidegates that are designed to divert or manage water. Investments to remove, repair, or replace structures that block fish and aquatic organism passage that improve habitat connectivity beyond the requirements of the HCP will provide mitigation for habitat loss or impacts on adjacent populations of covered species.

b. **Wood augmentation:** In reaches of the forested landscape where natural stream functions are altered by the lack of wood supply and recruitment due to legacy forest practices, large wood may be actively placed into streams as mitigation. Such placements should consider inclusion of root wads and be designed to simulate natural wood recruitment as feasible.

c. **Beaver conservation and reintroduction:** Beavers (*Castor canadensis*) are a keystone species that play a critical role in shaping natural landscape. The role that beavers play in creating habitat for salmonids is well documented (e.g., page 3-3 of the Recovery Plan for Oregon Coastal Coho, 2016). Conservation, active recruitment and reintroduction of beavers will restore landscapes to sustain and recover aquatic species covered by the HCP.

d. **Wildfire resiliency:** Uncharacteristically severe wildfires reduce the viability of aquatic species due to increases in fine sediment inputs, loss of riparian vegetation, and loss of wood to recruit to the system. Resiliency can be increased for aquatic species by developing and sustaining healthy riparian corridors and wet meadow complexes to reduce burn intensity during fires and protect streams from excess sediment inputs post-fire. Active recruitment and/or reintroduction of beavers, installation of beaver dam analogues, and completion of Stage 0 stream restoration projects are some tools available to accomplish these mitigation objectives.

e. **Restoration Treatments in Riparian Conservation Areas:** Densely stocked single-species stands of trees may provide riparian function more quickly if subjected to targeted treatments. The locations, character, and timing of such treatments needs further discussion (*See,* Chapter 2, Section 3.4(d)).
f. **Riparian thinning**: Restoration treatments within the Riparian Management Area that are designed and intended to enhance historic species diversity.

11.3.1.2 Land Preservation

The HCP Handbook describes land preservation as a "mechanism for preventing the impacts of development threats to covered species and their habitats on a particular property" (p. 9-15).

The Authors identified the following mitigation efforts related to land preservation for the purposes of the PFA:

a. **Conservation easements:** Riparian conservation easements outside of the covered lands may be used to mitigate impacts associated with timber practices. Easements on covered lands may be useful to help small forestland owners comply with new standards.

11.3.1.3 Threat Reduction or Elimination

The HCP Handbook also includes a category of mitigation measures related to the "removal or reduction of threats to improve the health of the system or reduce direct effects on covered species" (p. 9-17).

The Authors identified the following mitigation efforts related to threat reduction or elimination for the purposes of the PFA:

a. **In-stream flow:** Alterations to in-stream flow conditions can impact water temperature as well as the availability of habitat for aquatic species. The acquisition and in-stream transfer of water rights to improve in-stream flow conditions where lack of flow is currently a limiting factor or projected to be a limiting factor in the future can provide mitigation for timber practices that alter hydrologic and geomorphic functions.

b. **Grazing management:** Unrestricted grazing in riparian areas can degrade water quality because the loss of streamside vegetation reduces the stability of stream banks leading to increased sediment inputs and geomorphic changes such as increases in the width to depth ratio and straightening of stream channels. These geomorphic changes along with the loss of shade normally provided by woody vegetation, may also degrade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water temperature. Fencing off and grazing exclusion in riparian areas, and around seeps and springs, as well as the installation of off-stream stockwater systems or hardened watering gaps may be used to reduce the threat of grazing practices on aquatic species.

11.3.1.4 Other Mitigation Categories

The Authors identify the above specific mitigation categories and types, but nothing in this Chapter is intended to specifically preclude other mitigation measures that meet the objectives of the habitat conservation plan.

11.3.2 Mitigation Implementation

Mitigation will include both permittee-implementation, as well as in-lieu fee mitigation.

11.3.2.1 Permittee-Implementation

Under permittee-implementation of mitigation measures, the permittee is responsible for successfully completing the required compensatory mitigation to offset the incidental take (HCP Handbook, p. 9-19). Permittee-implementation may include wood augmentation, beaver reintroduction, riparian restoration, and other practices identified above on covered lands by private forestland owners.

11.3.2.2 In-Lieu Fee Mitigation

Under in-lieu fee mitigation, the permittee does not complete project-specific mitigation themselves. Instead, the permittee directs funds to an in-lieu fee mitigation sponsor that channels funding from an individual permittee or a collection of permittees towards a project or multiple projects. The permittee supervises the in-lieu fee mitigation project(s) managed by the mitigation sponsor and remains responsible for its mitigation obligations (HCP Handbook, p. 9-22).

For the purposes of the PFA, in-lieu fee mitigation may include all mitigation practices supported by money deposited in the Private Forest Accord Mitigation Subaccount of the Oregon Conservation and Recreation Fund (OCRF).

Industry shall pay $2.5 million per year for mitigation before the issuance of the incidental take permit, and $5 million per year after issuance of the incidental take permit. The funding shall continue at the $5 million annual level for the duration of the incidental take permit until an aggregate of $250 million in mitigation (counting both pre- and post-permit payments) has been paid. The State shall also contribute $10 million per year for mitigation.

a. **Establishment of the Private Forest Accord Mitigation Subaccount**

The Oregon Conservation and Recreation Fund (OCRF) was established by the Oregon Legislature in 2019 and is administered by the Oregon Department of Fish and Wildlife (ODFW). The OCRF

Advisory Committee advises the Oregon Fish and Wildlife Commission on the disbursement of funds from the OCRF.

As part of the PFA, a subaccount entitled the Private Forest Accord Mitigation Subaccount (PFAMS) shall be created in the OCRF to receive and dispense funds for the purposes of the PFA mitigation commitments.

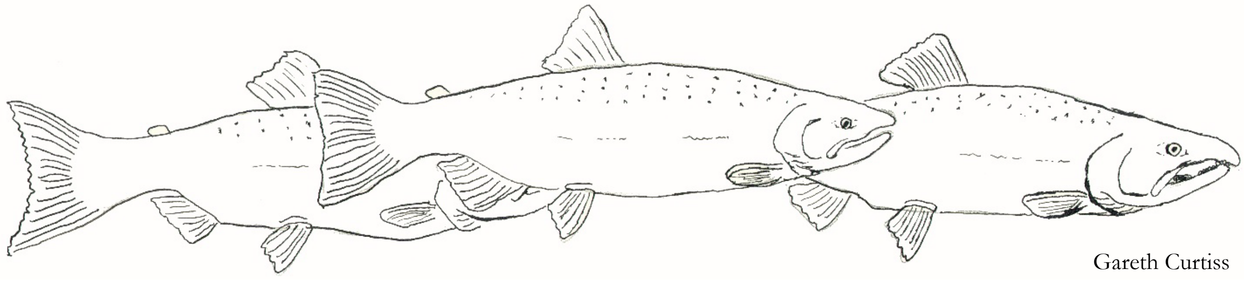
b. Establishment of the Private Forest Accord Mitigation Advisory Committee (MAC)

The Private Forest Accord Mitigation Advisory Committee (MAC) will be established by the PFA legislation as an advisory committee to the Oregon Fish & Wildlife Commission to make recommendations to the Commission regarding grants utilizing funds in the PFAMS. The MAC shall be organized in accordance with the following:

- **Purpose:** The purpose of the MAC is to assure that funds are invested in the projects that will generate the highest degree of mitigation for timber practices. Funds may also be used to conduct active outreach to landowners of fish passage barriers in order to meet fish passage targets, and other landowners who may participate in the mitigation efforts of the PFAMS.

- **Membership:** The MAC consists of seven voting members who may only be removed for cause. Three members of the MAC will be appointed by the Governor from non-governmental organizations that promote conservation of freshwater aquatic habitat. Three members of the MAC will be appointed by the Governor from the timber industry. One member of the MAC will be appointed by the Governor from the Oregon Conservation and Recreation Advisory Committee from among its members. Ex officio members may include a representative from NOAA, USFWS, ODF, OWEB, and ODFW. The initial cohort of MAC members shall be chosen by the Governor from the Authors. Future appointments made by the Governor shall be based on names solicited from relevant communities to maintain the balance of three members that represent non-governmental organizations that promote conservation of freshwater aquatic habitat, three members that represent the timber industry, and one member from the Oregon Conservation and Recreation Fund Advisory Committee.

- **Membership Terms:** The first cohort of members of the MAC shall include two members to serve terms ending one year after date of appointment, two members to serve terms ending two years after date of appointment, and two members to serve terms ending three years after date of appointment. All members will serve four-year terms following the



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completion of the first term of members of the initial cohort. Members may be reappointed, but no one person may serve as a member for more than two full terms.

- **MAC Officers:** Officers are elected by the MAC and include a Chair and a Vice-Chair.
  - The Chair creates the agenda in consultation with the Vice-Chair.
  - The Chair is re-elected by members of the MAC every two years.

- **MAC Meetings:** At times and places fixed by the Chair, the MAC will meet four times per year. Of those four meetings, the MAC will hold no more than two rounds of grant funding per year. The Chair may also call for additional field trips. All MAC meetings are public meetings and subject to Oregon's public meetings laws.

- **Voting:** Each of the seven voting members of the MAC shall be entitled to one vote on any decision presented at meetings at which the member is present. Vote will be by roll call. Final decisions will be made by voice vote. Members of the advisory committee should not abstain from voting except on a matter involving potential conflict of interest, in which case the reason for abstention will have been disclosed. Members must declare conflicts of interest and recuse from votes on projects in which they have a personal or professional stake.

- **MAC Duties:**
  - The MAC shall solicit on regular intervals applications for grant funding to support projects that will further the purpose described above.

  - The MAC will proactively identify and target investment opportunities in areas it identifies as important in furthering the purposes described above.

  - All applications to the PFAMS received by public solicitation by the MAC shall be ranked or scored under criteria developed by members of the MAC no more than one year after the enacting legislation and prior to soliciting the first round of applications to the PFAMS.

  - The MAC shall ensure that funds are invested in the projects that will generate the highest degree of mitigation for aquatic species covered by the habitat conservation plan envisioned by this Report. Funds may also be used to conduct active outreach to landowners of fish passage barriers in order to meet fish passage targets, and other landowners who may participate in the mitigation efforts of the PFAMS.


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- The PFAMS is eligible for matching to the main OCRF if matching funds are necessary to fully implement the proposed project are required.
- The MAC shall receive and consider recommendations from the OCRF Advisory Committee.
- The MAC shall seek out and identify opportunities to leverage funds in the PFAMS to obtain additional or matching funding for conservation efforts qualifying under this chapter. Such additional or matching funds may be managed within the PFAMS.

11.3.3 Timeline for Mitigation

The HCP should endeavor to provide for implementation of mitigation such that the offset would be achieved before the impacts of the taking occur, recognizing that funding will begin prior to receipt of the incidental take permit.

Annual tracking of mitigation implementation for both in-lieu fee and permittee implementation should be completed, with a comprehensive report of progress completed in coordination with the jurisdictional agencies every 5 years.

11.4 Literature Cited

U.S. Fish and Wildlife Service and NOAA Fisheries. 2016. Habitat Conservation Planning and Incidental Take Permit Processing Handbook. Available online < https://www.fws.gov/endangered/what-we-do/hcp_handbook-chapters.html >.

CHAPTER 12: FUNDING

12.1 Introduction

The Private Forest Accord (PFA) envisions a remaking of the Oregon Forest Practices Act in order to achieve approval of an aquatic-oriented Habitat Conservation Plan (HCP) for all of Oregon's private forestlands. The programs, oversight, and on-the-ground work envisioned in the PFA requires an increase in funding for the Oregon Department of Forestry, the Oregon Department of Fish and Wildlife, and the Oregon Department of Environmental Quality to meet the task ahead.

The Authors envision increased funding coming from multiple sources, including state and federal funds. The funding requested as part of the PFA will be used to augment current agency staffing, and it is likely that existing funding may be reprogrammed and integrated into new efforts envisioned under the PFA.

The Endangered Species Act requires that HCP applicants "ensure that adequate funding for the plan will be provided" (Section 10(a)(2)(B): (iii)). The negotiating parties encourage the State to sustain adequate funding for the life of the HCP to meet this requirement.

12.2 Goals

12.2.1 Federal Funding

The Authors envision that federal funding will be pursued by the State, in coordination with state agencies and the Authors, to support specific needs of the PFA and to augment agency budgets for programs under the PFA that are eligible for federal match or federal contribution. Specifically, federal funding will be pursued for: HCP application costs, data modeling, Small Forestland Investment in Stream Habitat program, small forestland owner fish passage, small forestland owner office agency staffing, LiDAR data, and other needs for which federal funding sources are later identified. Total estimated federal funding: $3 million for initial program roll-out and $7.5 million per year for ongoing implementation.

12.2.2 State Funding

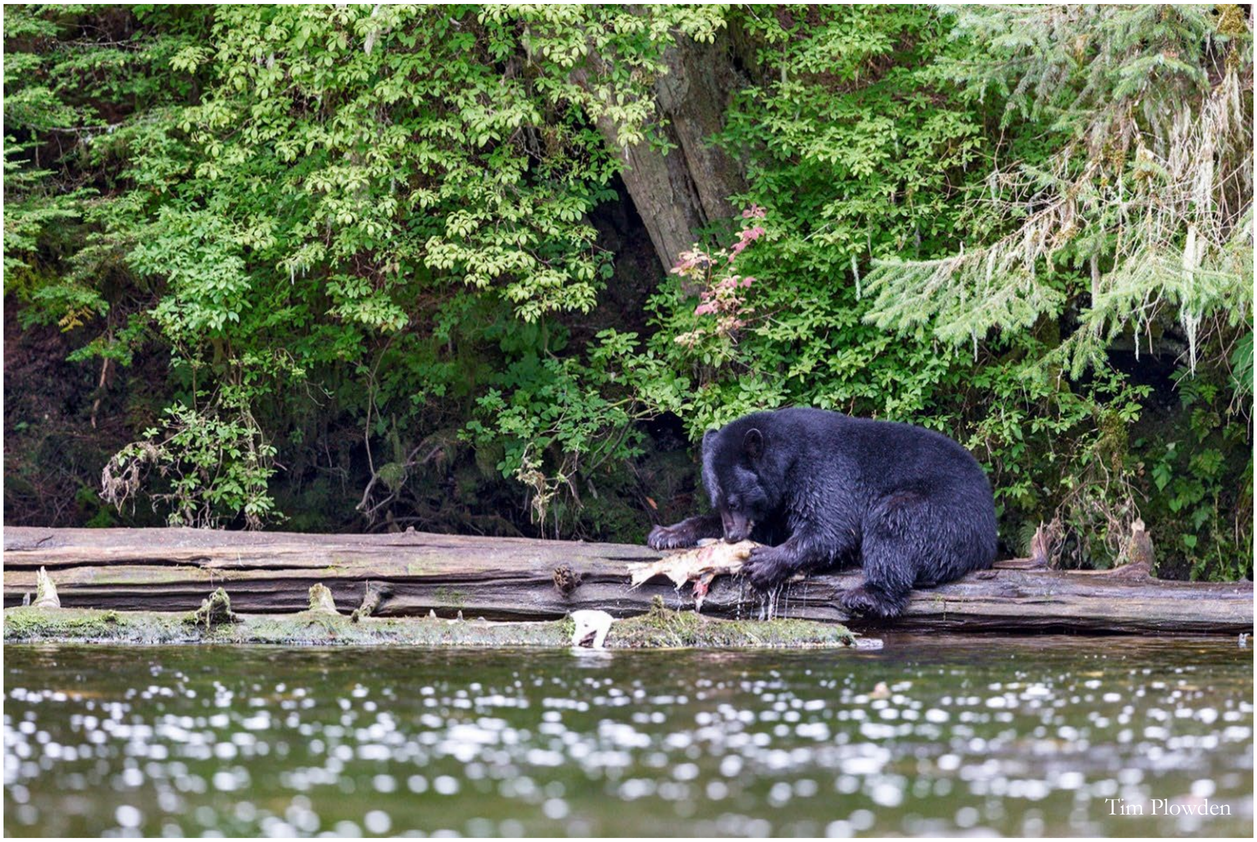
Many PFA needs are unlikely to be covered by federal funding and thus will require commitment from state funding sources. These programs likely include: updates to the FERNS notification system; hydrology and slopes modeling; staffing support for the roads inventory program; staffing for the small forestland owner office; compliance monitoring; enforcement; effectiveness monitoring, scientific research, and adaptive management; and administration and training for new rules. Total estimated state funding: $9.95 million for initial program roll-out and $16.17 million per year for ongoing implementation.

12.2.3 Mitigation

The goals and commitments of the Authors for mitigation are established in Chapter 11 of this Report. In addition to direct investments in PFA programs and staffing, the Authors agree to a mitigation fund to be supported by state dollars ($10 million per year beginning January 1, 2023) and a private industry pledge ($2.5 million per year beginning January 1, 2023, before issuance of an incidental take permit, and $5 million per year after issuance until reaching the cap of $250 million in aggregate). As contemplated in Chapter 11 and to be established by statute, the Private Forest Accord Mitigation Subaccount (PFAMS) will be created in the Oregon Conservation and Recreation Fund (OCRF) to receive and dispense funds for the purposes of the PFA mitigation commitments. Mitigation will include both permittee-implementation, as well as in-lieu fee mitigation. More details regarding the establishment and administration of the PFAMS are included in Chapter 12 of this Report.

12.2.4 Small Forestland Owner Tax Credits

The Authors have agreed to a Forest Conservation Credit, which will be a tax credit created by the PFA legislation for small forestland owners under various circumstances. The details of that tax credit program are detailed in Chapter 5 of this Report and SB 1502.



APPENDIX A: MEMORANDUM OF UNDERSTANDING

Appendix A: Memorandum of Understanding

The undersigned, being members of the Oregon timber industry and conservation communities (the "**Cooperating Parties**"), recognize and acknowledge the following:

A. The Cooperating Parties are presently embroiled in a costly and unpredictable battle over competing initiative petitions that would appear on the November 2020 ballot.

a. On July 9, 2019, Vikram Anantha, Micha Elizabeth Gross, and Kate Crump (the "**Forest Waters Petitioners**") filed three initiative petitions with the Secretary of State (the "**Secretary**") that the Secretary would assign initiative petitions numbers 35, 36, and 37 (the "**First Round IPs**"). The First Round IPs propose to make consequential changes to the regulatory regime surrounding Oregon forest practices, including aerial pesticide spray.

b. On September 24, 2019, the Secretary found that the First Round IPs do not comply with constitutional procedural requirements. On October 11, 2019, two of the Forest Waters

c. Petitioners filed a legal challenge to the Secretary's finding on the First Round IPs and the challenge is now pending in the Oregon Court of Appeals.

d. On October 2, 2019, the Forest Waters Petitioners filed three more initiative petitions that the Secretary would assign numbers 45, 46, and 47 (the "**Second Round IPs**," and together with the First Round IPs, the "**Forest Waters IPs**"). The Second Round IPs include most of the substantive provisions of the First Round IPs, but exclude certain provisions to comply with the Secretary's finding on the First Round IPs.

e. On November 5, Jim James, Scott Russell, and Neil Westfall (the "**Landowner Petitioners,**" and together with the Forest Waters Petitioners, the "**Petitioners**") filed initiative petitions that the Secretary would assign numbers 53, 54, and 55 (the "**Landowner IPs**" and together with the First Round IPs and the Second Round IPs, the "**Initiative Petitions**"). IP 53 would require state compensation for certain regulations. IP 54 would alter the procedure for adopting new forest practice regulations. IP 55 would change the composition of the Oregon Board of Forestry.

f. On January 13, the Secretary found that IP 54 does not comply with constitutional procedural requirements.

g. Certified ballot titles for the Second Round IPs, IP 53, and IP 55 have all been appealed to the Oregon Supreme Court (the "**Appeals**").

B. The Cooperating Parties acknowledge that they have an incentive to reach a compromise on historically difficult issues without risking adverse outcomes in an election.

C. The Cooperating Parties believe that any compromise must be built on mutual trust and respect, and to that end must achieve the following overall goals:

a. Greater business certainty: Provide a greater level of certainty to forest landowners and industries that depend on Oregon forests without compromising the viability of Oregon's manufacturing infrastructure.

b. Greater environmental certainty: Provide a greater level of certainty for the survival and recovery of threatened and endangered species, and ensure that drinking water, and aquatic resources are protected.

c. Process to resolve future issues: Provide a durable framework and process leading to substantive outcomes to address current and future issues related to achieving greater business certainty and greater environmental certainty as described herein that is outside the initiative process and legal system.

d. Complete a stand-down from pursuing changes through the initiative process, related legal actions, and certain other relevant legislative and regulatory proceedings while the facilitated process is working.

D. The Cooperating Parties stand to gain by pursuing an alternative path informed by science with a mutual willingness to compromise that achieves high quality environmental outcomes and certainty for everyone involved.

NOW, THEREFORE, the Cooperating Parties share the following intentions:

1. The Cooperating Parties will pursue a science-informed policy development process, rooted in compromise, to evaluate and jointly recommend substantive and procedural changes to Oregon forest practice laws and regulations as outlined below:

    a. A mediated series of meetings over the course of no more than eighteen months. The object of these meetings is to finalize a plan to prepare an application to the federal services through changes to Oregon's Forest Practices Act and implementing regulations that will provide a rational basis for an approvable Habitat Conservation Plan, or other mechanism for federal regulatory assurances, covering listed salmonids and other aquatic and riparian-dependent species.

    b. The mediated meetings will include representatives of the federal services and relevant state agencies.

    c. The mediated meetings will include discussion of forest practices that impact waters of the state and at risk species including, but not limited to, forest roads, near-stream operations, and steep/unstable slope activities affecting streams.

    d. The Cooperating Parties will develop their final plan so that interim legislation implementing the agreements reached will be enacted on or before the February 2022 Legislative session. Such implementing legislation will include:

        i. Elements that decrease the risk to listed species and the aquatic resources upon which they rely while increasing certainty and durability of forest practice laws and regulations going forward.

        ii. An adaptive management component that involves a rigorous look at the efficacy of existing and future forest practice regulation, and a science-driven process for analyzing the need for any changes.

        iii. Recognition of the potential for disproportionate impacts to small forest landowners and provision for alternative compliance paths and mitigation of financial impacts.

        iv. A sunset for the 2022 legislation if the federal services fail to issue a final record of decision approving a statewide habitat conservation plan, or other federal mechanism for regulatory assurance, by December 31, 2027, or the incidental take permit is otherwise revoked on appeal.

    e. The Cooperating Parties will present an update on the mediated process and their progress toward accomplishing goals during the 2021 Legislative session.

f. The Cooperating Parties recognize the importance of forestry and aquatic resources to Native American tribes, and understand that the state and federal governments will consult with tribal governments on these issues as this process moves forward and any resulting policy changes.

2. The Cooperating Parties will observe the ground rules attached as Exhibit A, and any other ground rules mutually agreed to in the subsequent mediation. The Cooperating Parties will publicly support:

    a. Pesticide spray legislation that includes the components described in the attached Exhibit B.

    b. Enabling legislation for the process described in Section 1 that includes public funding for third party or public staffing and technical resources.

    c. Legislation that directs the Board of Forestry to extend as interim rules the 2017 salmon, steelhead and Bull trout stream rules to the Siskiyou Georegion at the soonest possible date consistent with current administrative procedures, and suspension of the Siskiyou riparian review process. These rules may be changed as part of the implementing legislation envisioned by 1.d. above.

3. The Cooperating Parties will agree to a mediator to facilitate the process described in Section 1.

4. Provided the legislation described in Section 2 passes the Oregon legislature no later than March 9, 2020, and the Cooperating Parties agree to the mediator in Section 3, the undersigned will:

    a. Endeavor to cause:

        i. The Petitioners to withdraw and terminate the Appeals and any then-pending litigation concerning the Initiative Petitions, except for litigation regarding the First Round IPs, which the Forest Waters Petitioners intend to prosecute to final resolution in the normal course.

        ii. The Forest Waters Petitioners to withdraw the Forest Waters IPs, except that this subsection will not apply to the First Round IPs until the associated litigation is fully and finally resolved.

        iii. The Landowner Petitioners to withdraw the Landowner IPs.

        iv. The Petitioners to close any political action committee connected to the Petitions.

    b. Testify before the Board of Forestry in support of suspending work on the coho rulemaking, and opposing any new petitions for resource site protection rulemakings for aquatic species, during the pendency of this process or the passage of the 2022 Legislative session, whichever concludes earlier.

c. Encourage the Board of Forestry to analyze the safety and efficacy of aerial pesticide application by unmanned aerial vehicle if and when such technology becomes commercially viable.

d. Not initiate or support new proposals for regulation of aerial pesticide applications on Oregon forestlands until the earlier of (i) the Cooperating Parties ceasing work on an approvable Habitat Conservation Plan pursuant to Section 1(a) above, or (ii) December 31, 2027.

5. Except as provided in Section 1.e., the expressions of intent set forth in this Memorandum of Understanding, although containing an agreement in principle, shall not be binding on the Cooperating Parties.

[SIGNATURES BEGIN ON FOLLOWING PAGE]

COOPERATING PARTIES

Sean Stevens, Executive Director
Oregon Wild

Steve Zika, President & CEO
Hampton Lumber

Bob Van Dyk, Policy Director for Oregon
Wild Salmon Center

Devin Stockfish, President & CEO
Weyerhaeuser

Mary Scurlock, Coordinator
Oregon Stream Protection Coalition

Grady Mulbery, President & CEO
Roseburg Forest Products

Lisa Arkin, Executive Director
Beyond Toxics

Todd Payne, President & CEO
Seneca Sawmill Company

Bob Sallinger, Conservation Director
Audubon Society of Portland

William E. Peressini, President & CEO
Hancock Natural Resource Group

Josh Laughlin, Executive Director
Cascadia Wildlands

Andrew Miller, CEO
Stimson Lumber

Michael Dotson, Executive Director
Klamath Siskiyou Wildlands Center

Toby Luther, President & CEO
Lone Rock

Glen Spain, Northwest Regional Director
Pacific Coast Federation of Fishermen's
Associations

Jeff Nuss, President & CEO
Greenwood Resources

Chandra Ferrari, Senior Policy Advisor
Trout Unlimited

Stan Petrowski, Board Representative
Umpqua Watersheds

Bob Rees, Executive Director
Northwest Guides and Anglers

Stacey Detwiler, Conservation Director
Rogue Riverkeeper

Doug Moore, Executive Director
Oregon League of Conservation Voters

John Gilleland, CEO
Campbell Global

Randy Hereford, President & CEO
Starker Forests, Inc.

Tom Ringo, President & CEO
Pope Resources

Court Stanley, President, US Forestry
Port Blakely

Jim James, Executive Director
Oregon Small Woodlands Association

EXHIBIT A
Ground Rules

Each of the participants to these discussions agree to these ground rules:

1. We will attempt to develop a system which provides:
* Minimum guarantees for everyone;
* Incentives which maintain and enhance timber, fisheries and wildlife resources;
* Future flexibility, accountability, better management, compliance with regulations and resource goals.
2. All participants in the negotiation are to bring with them the legitimate purposes and goals of their organizations. All parties recognize the legitimacy of the goals of others and assume that their own goals will also be respected. These negotiations will try to maximize all the goals of all the parties as far as possible.
3. This effort will receive priority attention, staffing and time commitments.
4. Give the same priority to solving the problems of others as will your own.
5. Commitment to search for opportunities: without creativity there will be no plan or agreement.
6. Commitment to listen carefully: ask questions to understand and make statement to explain or educate.
7. All issues identified by any party must be addressed by the whole group.
8. State needs, problems and opportunities, not positions — positive candor is a little-used but effective tool.
9. Commitment to attempt to reach consensus on a plan.
10. Commitment to be an advocate for an agreed plan.
11. Attempt to protect each other and process politically with constituencies and general public.
12. Weapons of war are to be left at home (or at least at the door).
13. Anyone may leave the process and the above groundrules, but only after telling the entire group why and seeing if the problem(s) can be addressed by the group.
14. All communications with news media concerning these discussions will be by agreement of group. Everyone will be mindful of the impacts their public and private statements will have on the climate of this effort.
15. No participant will attribute suggestions, comments or ideas of another participant to the news media or non-participants.
16. All rights, remedies, positions and current prejudices are available to everyone if the effort is unsuccessful.
17. Participants are free to, and in fact are encouraged to, seek the best advice from their friends and associates informed of the progress of the discussions.
18. All of the individuals who are participants accept the responsibility to keep their friends and associates informed of the progress of the discussions.
19. If you hear a rumor, call facilitator before acting on it.

EXHIBIT B
OREGON FOREST HELICOPTER PESTICIDE LEGISLATION COMPONENTS

Initial Notification

1) Concerned Oregonians (each, a "**Recipient**") may register with the Oregon Department of Forestry ("**ODF**") to receive notifications of nearby helicopter applications of pesticides (as defined in ORS 634.006 (8)), but not including helicopter applications of fertilizers, by providing to ODF (a) a description of the relevant parcel (b) proof of residency on that parcel, and (c) contact information, including the Recipient's mailing address, email address, and phone number. These parcels ("**Flagged Parcels**") will be reconciled by ODF with tax lots that will be flagged in a geospatial layer maintained within ODF's Forest Activity Electronic Reporting and Notification System ("**FERNS**"). Similarly, a person in control of the surface water intake for a permitted water right, or who owns and operates a spring box that the person certifies is an exempt use of Oregon water (each, a "**Water User Recipient**"), may register with ODF to receive notifications of helicopter pesticide applications by providing to ODF (a) the Global Positioning System ("**GPS**") coordinates of the intake or spring box, (b) proof of the Water User Recipient's ownership or control of the intake or spring box, and (c) contact information, including the Water User Recipient's mailing address, email address, and phone number. ODF will log the location of the registered intakes or spring boxes (the "**Flagged Water Sources**") in FERNS.

2) For all notifications of helicopter pesticide applications on forestlands, the operator must identify a ninety-day window within which the operation will occur (the "**Application Window**"). Operations outside the Application Window would require a new notification. All notifications of helicopter pesticide applications on units with at least one Nearby Recipient (as defined below) must be made at least thirty days prior to conducting an operation, unless the operation was previously notified within the same calendar year and not completed, in which event the operation must be notified at least one week prior to conducting an operation (notwithstanding ORS 527.670(9)).

3) Today, when a landowner or operator files a notification with FERNS, it produces a list of intersects with other resources and regulatory layers (e.g., streams, resource sites). Under the proposed legislation, for all helicopter pesticide applications, FERNS would create for the notifier a list of (a) all Recipients with a Flagged Parcel within one mile of the boundary(ies) of the proposed operation(s), and (b) all Water User Recipients with a Flagged Water Source within one mile of the boundary(ies) of the proposed operation(s) and within the same drainage basin (each described by (a) and (b), a "**Nearby Recipient**"). The landowner and/or operator would have the first opportunity to reach out to any Nearby Recipients in person, but two weeks following the notification, FERNS would automatically generate an email to each Nearby Recipient notifying them of the proposed operation, the Application Window, and the contact information for the landowner and operator.

4) All notifications of helicopter pesticide application should only list pesticides reasonably likely to be used.

Real-Time Notification

5) To perform a helicopter pesticide application on any given day, a landowner and/or operator must, prior to 7:00 pm on the preceding day, make an election within FERNS to perform a helicopter pesticide application the following day (a "**Go Election**"). The Go Election may be made for single or multiple units within each notification (a single notification frequently contains many units). A Go Election will immediately prompt an email to each Nearby Recipient within one mile of the boundary of the relevant unit(s), notifying them of the possibility of an application the following day. A Go Election would not require the operator complete an application the following day. Provided that the application would still occur within the Application Window, an operator may make a Go Election on multiple or succeeding days.

Post Application Completion Reporting

6) Within 24 hours of completion of a helicopter pesticide application, an operator must identify within FERNS the units completed. FERNS will offer the operator the list of the operator's units for which a Go Election was made from which the operator may select the completed units.

7) All units identified by the operator for helicopter pesticide application in FERNS will be designated "available," "pending," or "completed." During an Application Window, but prior to a Go Election, a unit will be designated as "available." Between a Go Election and the reporting required by the preceding section, a unit will be designated as "pending." A unit for which the operator has reported a completion will be marked as "completed." If an operator does not make any report following a Go Election, then at 11:59 pm on the second day following the Go Election the unit will automatically be re-designated as "available."

8) An operator who makes a Go Election and then makes a helicopter pesticide application but who does not timely report the unit's completion shall be subject to graduated penalties for each day they fail to report, that begin with a warning, and increase to $1,000 for the second day in a single season, and $5,000 for each additional day in a single fall or spring spray season.

9) The legislation would (a) explicitly provide a mechanism for the request of daily spray records by state agencies, law enforcement, and licensed health care providers by request to the Pesticide Analytical Response Center (b) require production of daily spray records within twenty-four (24) hours of request to the operator, (c) require production of any unit spray pattern data, including but not limited to any GPS information within five (5) business days of request, (d) increase financial penalties for failure to timely produce a daily spray record or flight path data upon request, and (e) provide that such information is not otherwise public record subject to request.

Penalties for Interfering with Helicopter Pesticide Applications

10) Any person who intentionally interferes with a helicopter pesticide application may be ticketed for a violation with a presumptive fine of $1,000 for the first offense, and $5,000 for any additional offense within a five-year period, and may be liable to the operator for any actual damages resulting from the interference or other remedies available at law. Any interference by a Nearby Recipient shall be deemed to be intentional. There shall be a rebuttable a presumption that any interference is intentional if caused by a Recipient or a Water User Recipient who registers a Flagged Parcel or Flagged Water Source pursuant to Section 1 above.

Miscellaneous

11) The "go-live" date for the foregoing software enhancements for FERNS would be no less than one year following the enabling legislation. The "go-live" date may be extended twice in six-month increments should the state Chief Information Officer, in consultation with the Cooperating Parties, determine that the software enhancements are not ready for use in the field. Until the "go-live" date, current rules will continue to apply.

12) Particularly with respect to the Real-Time Notification and Post Application Reporting described above, ODF would be specifically instructed to create an application for iPhone and Android that is convenient to use on a cell phone in the field anywhere a data connection is available.

13) Software development would require adequate funding.

14) The legislation would establish helicopter pesticide application buffers (no direct application zones) of 300 feet around inhabited dwellings and schools that are not owned by the landowner receiving the application and around any Flagged Water Source within the same 6th level hydrologic unit. Inhabited dwellings and schools have the definitions currently appearing in Oregon Department of Forestry Guidance for ORS 527.672 Aerial Herbicide Applications dated May 25, 2018, but would exclude trespassers.

15) The legislation would, subject to any product label or federal law requiring more stringent standards, establish the following helicopter pesticide application buffers (no direct application zones) adjacent to streams on forestland governed by the Oregon forest practices act:

    a) On fish bearing streams and on Type-D streams, the larger of (i) the riparian management area as of the implementation date of the buffers required by Section 2(c) of the Memorandum of Understanding to which this Exhibit B is appended., (ii) the required vegetated buffer, or (iii) 75 feet; and,

    b) On flowing Type-N streams that are not Type-D streams, 50 feet.

16) The provisions of sections 14 and 15 above will go into effect on January 1, 2021.

APPENDIX B: DELINEATING LANDSLIDE AND DEBRIS FLOW SUSCEPTIBILITY

Appendix B. Delineating Landslide and Debris Flow Susceptibility in Western Oregon in Support of the Private Forest Accord

TerrainWorks, January 27, 2022

Governor Brown states that "*this agreement* (the Private Forest Accord, PFA) *will help to ensure that Oregon continues to have healthy forests, fish, and wildlife, as well as economic growth for our forest industry and rural communities, for generations to come*"[10]. To meet these goals requires an understanding of how human interactions with the landscape will affect forests, fish, and wildlife for generations to come. In

[10] https://www.oregon.gov/newsroom/pages/NewsDetail.aspx?newsid=64523

Oregon, landslides and timber harvest are important components of this interaction. This document presents an overview of the background, approach, and methods concerning the prediction of landslide and debris flow susceptibility in Western Oregon. The focus here is on fish, and hence on interactions between landslides, forests, and river-stream environments.

1.0 Background

The ecology of river systems is driven by spatial and temporal variations in water flow – the flow regime (Poff et al., 1997). River ecology also responds to variations in channel and riparian morphology (Montgomery, 1999; Vannote et al., 1980). Sediment supply is an important control on this morphology, so the ecology of river systems is also driven by spatial and temporal variations in sediment supply. Numerous studies find that landslides and associated debris flows[11] dominate the supply of sediment to streams in the Oregon Coast and Cascade Ranges naturally, even in the absence of land use (Benda and Dunne, 1987; Swanson et al., 1982). The same is found for mountainous terrain throughout the world (Kirchner et al., 2001; Lehre, 1982; Miller et al., 2002). In these environments, sediment supply varies dramatically in time and space, controlled by the timing and location of landslide events – the disturbance regime (Benda et al., 1998). This disturbance regime is a fundamental factor in the ecology of river systems in these landscapes (Reeves et al., 1995), so knowledge of how this regime functions is necessary to anticipate the consequences of land use decisions.

When they occur, debris flows overwhelmingly alter channels and riparian zones: steep channels may be completely scoured of bed material and riparian vegetation stripped for meters on either side. Deposition can bury channels and riparian zones under meters of debris, destroying whatever habitat was there before. These are the obvious impacts; less obvious is what happens next. Neighboring populations of plants and invertebrates can rapidly recolonize impacted zones, with fish quickly following (Everest and Meehan, 1981; Foster et al., 2020). Loss of riparian trees results in greater insolation with higher water temperatures and increased primary productivity (Kiffney et al., 2004; Lamberti et al., 1991). Riparian vegetation grows rapidly, with shifts in species composition and abundance (Pabst and Spies, 2001), eventually reestablishing shade and lower water temperatures (Johnson and Jones, 2000). Flowing water rearranges sediment in the deposit, reforming pools and other channel features important to fish habitat (Roghair et al., 2002).

Each debris flow event can dramatically alter local channel and riparian environments, initiating a decades-long trajectory of changing vegetation and aquatic habitat conditions. Each event affects only a small part of the channel network, but there may be thousands of debris flow sites, so the temporal sequence, spatial distribution, and abundance of debris flows sets, in part, the patterns of riparian and channel habitat diversity within a basin (Swanson et al., 1998). Large storms can simultaneously trigger vast numbers of landslides and associated debris flows (Robison et al., 1999; Turner et al., 2010). Particularly if associated with widespread forest disturbance such as wildfire (Benda and Dunne, 1997a, b), these spates of landsliding might produce changes in habitat type throughout an affected basin, potentially shifting for example, bedrock-dominated systems to

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[11] Landslides in Oregon often involve failure of shallow soils, typically less than 2 meters in depth, overlying bedrock on steep slopes. If the failed debris enters a topographically constrained channel on the hillslope, it can evolve into a fluidized slurry of mud, rocks, and logs, called a debris flow (also a debris torrent), that can travel long distances downslope, in some cases to deposit in channels and debris fans on the valley floor.

channels buried in gravel (Reeves et al., 1995). Gravel is essential for spawning, but too much results in loss of surface water during low-flow seasons with consequent fish mortality (May and Lee, 2004). In debris flow terrain, the history of debris flow events acts in part to determine the abundance, distribution, and diversity of channel and riparian habitat types, both within a basin and across a region, a dynamic regime that fish species occupying these environments have evolved to capitalize on (Flitcroft et al., 2016; Miller et al., 2008; Naiman et al., 1992; Reeves et al., 1995).

Debris flow deposits also form an important geomorphic template for channel systems. These deposits create fans and terraces that strongly influence stream and associated habitat characteristics (Benda et al., 2003a; Benda et al., 2004; Grant and Swanson, 1995; May and Gresswell, 2004). The large wood and boulders carried to the valley floor with these deposits create sources of roughness in channels that can persist for centuries (Benda, 1990). Large wood and boulders create flow diversions that form pools and obstructions that store sediment, adding to habitat diversity (Beechie and Sibley, 1997; Montgomery et al., 1996; Nakamura and Swanson, 1993; Roni et al., 2006). Thus, accumulations of boulders and large wood found at debris flow fans (Bigelow et al., 2007), even in the absence of any recent debris flow events, are associated with locally increased sediment accumulations and pool abundance (Benda et al., 2003).

Debris flow-triggering landslides primarily occur during intense rainstorms (Robison et al., 1999; Turner et al., 2010). Forest cover reduces landslide potential through the tensile strength provided by dense mats of roots (Schmidt et al., 2001) and by modulating peaks in soil pore pressures during storms (Dhakal and Sullivan, 2014; Keim and Skaugset, 2003; Keim et al., 2004). Loss of forests to wildfire, disease, and windstorms can thus locally increase storm-driven landslide rates for a decade or more until tree cover is re-established (Sidle and Ochiai, 2006). The cadence of landsliding across a basin is thereby driven by the sequence and spatial distribution of storms and forest disturbances. Timber harvest can alter this cadence by increasing landslide rates with consequent increases in sediment supply to streams (Benda and Cundy, 1990; Ketcheson and Froehlich, 1978; Montgomery, 1994; Oregon Department of Forestry, 2006; Reid and Dunne, 1984; Robison et al., 1999; Swanson et al., 1987; Swanson and Fredriksen, 1982; Swanson et al., 1977; Turner et al., 2010). Landslides have typically been viewed as hazards in the context of forestry activities (Benda and Cundy, 1990; Montgomery et al., 2000; Sidle et al., 1985) and mitigation is a high priority at locations where lives and property are at risk, as reflected in Oregon Forest Practice Rules (OAR 629-623-0000 through 0800, Forest Practices Technical Note Number 2 and Number 6).
Debris flow interactions with forests affect channels in a variety of ways. Large trees carried to channels by debris flows provide long-term sources of roughness, serving to enhance sediment retention and pool formation (as described above), but the relative importance of these debris flow sources for overall channel morphology varies with the availability of large wood from riparian zones: the proportion of large wood from debris flows increases as the supply of large wood by channel-adjacent tree fall decreases (Montgomery et al., 2003). In industrial forests, which may currently lack riparian sources of large wood due to past timber harvests, debris flows can thus provide the only source of wood large enough (e.g., > 0.6m diameter) to effectively alter channel morphology and create fish habitat in many channels.

This highlights the importance of riparian sources of large trees and of a supply of large wood for recruitment by debris flow for establishing and maintaining channel morphologies conducive to development of high-quality habitat. Debris flows pick up down wood that accumulates in the steep headwater channels they traverse (May and Gresswell, 2003). Wood from trees and sediment falling into these channels accumulates over time, until a debris flow scours accumulated material and transports it downstream. Some portion of the accumulated wood is lost to decay, but wood buried in these small channels can persist for long periods. May (2002) found that the volume of wood in debris flow deposits increased with longer runout length and that the diameter distribution of pieces in the deposit was independent of tree size in the stand traversed, indicating that much of the wood in the deposit originated from down wood from pre-harvest stands stored in the traversed channel. The size distribution and abundance of trees in currently growing stands adjacent to debris flow-prone headwater channels today thus dictate the size of wood carried to fish-bearing channels by debris flows in the future. Likewise, once a debris flow occurs, accumulation of sediment in the scoured channel initially occurs upslope of trees that fall into the channel (May and Gresswell, 2003). Scoured channels lacking sources of large wood to act as sediment dams may persist as passageways for water-transported sediment to downstream channels.

Forests also affect debris flow runout. Large wood incorporated into a debris flow from standing and down trees reduces runout length (Booth et al., 2020; Ishikawa et al., 2003; Lancaster et al., 2003; May, 2002). Debris flow volumes tend to increase with runout length, so deposit volumes tend to be larger for debris flows that traverse stands of smaller trees (May, 2002).

Historical context is also an important factor when evaluating the effects of landslides on channel environments in western Oregon. Streams and rivers in the Coast and Cascade Ranges have a history of splash dams and log drives between the mid-1800s and the early twentieth century (Miller, 2010b; Phelps, 2011; Sedell and Luchessa, 1981). These required the removal of wood jams and rocky obstructions from channels. The lack of riparian buffers, in association with logging through the 1970s, led to slash and debris entering streams. This motivated the practice of stream cleaning, which continued until the late 1970s (House and Boehne, 1987). Between 1956 and 1976, the Oregon Game Commission removed large wood from channels for the mistaken purpose of enhancing fish habitats and passage (Oregon Department of Forestry, 2003). These activities have contributed to the generally low volumes of large wood in Western Oregon streams today.

These past practices caused many channels to be scoured to bedrock (Miller, 2010a) and the lack of large wood now further contributes to lower volumes of gravel storage (Montgomery et al., 2003). Consequently, in-channel restoration efforts often place log structures in streams (Banks et al., 2001; Oregon Department of Forestry, 2003) to catch sediment and stream-transported wood and to create pools. Boulders have also been placed in channels to mimic debris flow deposits and to enhance habitat complexity (Mueller, 2009). The artificial deposits of wood and boulders have been shown to create larger pool areas and to attract higher densities of juvenile coho and trout (Roni et al., 2006). Ultimately, strategies for habitat restoration and maintenance in a managed landscape must seek to identify and preserve the processes and process rates that create and maintain needed habitats (Beechie et al., 2010).

Recognition of the ecological role of landslides and debris flows has led to calls to modernize the management of steep slopes in Oregon. To maintain the shallow-rapid landslide processes and rates that create and preserve habitats in fish-bearing streams, one approach is to reduce the amount of timber harvest on landslide-prone terrain. Another is to maintain sources of large wood along the corridors traversed by debris flows (Burnett and Miller, 2007). These approaches have been adopted by Oregon State Forest Management Plans and by HCPs that are in development as of 2021 on State Forest Lands, the Elliott State Forest, and private commercial forests (Private Forest Accord).

Together, these HCPs involve over 50,000 km^2 of forest lands in Oregon. Effects of forest management on landslide processes and consequences for fish habitats are important issues in all three. The approach and methods described below were developed with the recognition that landslides and debris flows are intrinsic drivers of ecological processes in these landscapes. The models are applied to quantify landslide initiation and runout potential to aid in development of prescriptions for forest management acting in concert with ecological processes.

2.0 Predicting Shallow Landslide and Debris Flow Runout

Development of models for predicting locations of shallow landslides and debris flow runout in Western Oregon began in the early 1990s (Benda and Cundy, 1990). By the mid-1990s, digital elevation models were being employed for predicting susceptibility to shallow failures (Montgomery and Dietrich, 1994). Comprehensive landslide inventories (including landslides under forest canopy) following the large 1996 storms in the Coast Range (Bush et al., 1997; Robison et al., 1999) were used to build empirically calibrated landslide susceptibility and debris flow runout models (Miller and Burnett, 2007, 2008). The advent of these tools, combined with the newly available higher-resolution digital elevation models (DEMs) from LiDAR, led to calls to identify and protect upland landslide and debris flow sources of large wood to fish streams (Burnett and Miller, 2007; Reeves et al., 2016). As part of the PFA prescriptions for steep slopes, the models of Miller and Burnett (2007, 2008) are being used to delineate areas susceptible to shallow failures and the runout of debris flows delivering to fish-bearing streams.

The Miller and Burnett (2007) model of shallow landslides is based on recognized causes of shallow landslide initiation in the Coast Range (Dietrich and Dunne, 1978; Dunne, 1991; Montgomery and Dietrich, 1994; Pierson, 1977). Shallow landslide potential is defined in terms of a topographic index that is based on hillslope steepness, planform curvature, and critical drainage area (area per unit contour length) (Miller and Burnett, 2007). Landslide locations from the field-based landslide inventories (Robison et al., 1999) were used to calibrate the index for the purpose of associating landslide susceptibility (in terms of landslide density, number per km^2) to terrain attributes and forest cover. Landslide susceptibility is quantified in terms of the relative proportion of all landslides predicted to occur within particular topographic zones.

The Miller and Burnett (2008) model of debris flow runout is used to identify stream channels susceptible to traversal and deposition from debris flows. The model integrates susceptibility to landslides (as described above) into debris flow initiation and estimates of runout probability. Thus, the two models are coupled. Critical parameters for predicting debris flow runout include channel steepness, channel confinement, tributary junction angles, and rates of debris scour and deposition (Miller and Burnett, 2008). For a watershed, the model predicts channel susceptibility to debris flow traversal in terms of the proportion of total debris flow-track length expected within any subset of headwater streams (Burnett and Miller, 2007). The Miller-Burnett model is used to rank channels in terms of relative frequency of traversal by debris flows that travel to fish-bearing channels. In the PFA prescriptions, the Miller-Burnett models were used to: 1) identify source areas for landslides and debris flows that could potentially travel to fish-bearing streams, and 2) identify travel paths for debris flows that could deliver sediment and large wood to those streams. The modeling is intended to identify and rank specific landslide initiation source areas and debris flow runout in headwater channels in USGS HUC 4th field (8-digit) basins. This basin size was selected to match the NOAA-

Fisheries designations for watersheds that contain ecologically significant independent populations of coastal coho salmon in the Oregon Coast Range.

3.0 Model Application

3.1 Creation of a Synthetic River Network and Virtual Watershed

Basin hydrography is represented in digital form as a synthetic network, a stream layer in GIS (**Figure 1**), derived from high-resolution (1-m) Lidar-generated DEMs. Delineated channels must accurately follow actual channel courses, they must extend upstream to include channelized portions of potential debris flow corridors, and they must include attributes for determining likelihood of fish use and flow duration (perennial flow).

The DEM-traced channel courses follow geomorphic indicators of channel presence derived from the DEM. These indicators are used by the US Geological Survey for elevation-derived updates to the National Hydrographic Dataset[12] and include plan curvature (Florinsky, 2016) and flow accumulation calculated using the D-Infinity flow-direction algorithm (Tarboton, 1997). We preclude dispersion of flow along channelized flow paths, so once the criteria for channel initiation are met, D-8 flow directions are used (Clarke et al., 2008), in which flow path out of a DEM cell is directed to one of the eight adjacent cells. This introduces a bias for flow paths that do not follow one of these eight directions, which is corrected by tracking deviations along traced flow paths (Orlandini and Moretti, 2009).
Upstream extent of traced channels is determined using three criteria (Clarke et al., 2008; Miller et al., 2015).

1. Threshold for the product of specific contributing area and gradient squared $(A/b)S^2$, where A = contributing area to DEM cell, b = contour length crossed by flow out of the cell, S = surface gradient, calculated over a length scale appropriate for channel-forming processes (e.g., 20m).
2. Threshold for plan curvature. Topographic evidence of a channel is manifest as a crenulation in a contour line, defined as plan curvature. High curvature measured over a length scale appropriate for resolving a channel is interpreted as evidence of a channel.
3. Threshold for flow length. The hillslope length scale over which the $(A/b)S^2$ and plan curvature thresholds must be met.

The product of contributing area and gradient squared is representative of the erosion potential of processes that create channels (Montgomery and Foufoula-Georgiou, 1993). This threshold is determined by plotting threshold value versus channel density on a log-log plot; an inflection in the plot indicates the point where delineated channels extend onto planar (unchannelized) hillslopes (Clarke et al., 2008). This inflection provides a rough measure of the degree to which the DEM can

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[12] Methods for derivation of NHD flow paths from high-resolution elevation data are still in development and a citation is not currently available.

resolve valley and hillslope swale features. Plan curvature is a measure of local topographic convergence (i.e., degree of crenulation of a contour line) and serves to further delineate potential channels resolved by the DEM. Finally, these two thresholds must persist for a specified flow length so that small depressions (e.g., tree-throw pits) are not identified as channel initiation sites. The area-slope threshold is calibrated from the DEM; the plan curvature and minimum length thresholds are set subjectively so that traced channels persist upslope to a point consistent with the expected upslope extent of channelized debris flows. Thresholds may be spatially variable to reflect different processes that form channels, e.g., landslides on steep slopes, overland flow and subsurface piping on low-gradient slopes (Clarke et al., 2008). Likewise, threshold values vary regionally, reflecting differences in local conditions and in DEM characteristics.

The channel network is represented digitally as a set of linked nodes; one node for each DEM grid point traversed by each channel (**Figure 2**). This data structure maintains information at the smallest spatial grain available from the elevation data. Channel attributes for each node, such as gradient and confinement, are calculated from the DEM[13]. These attributes are then applied in the models used for the PFA analyses. Fish-bearing streams (anadromous and resident), for example, are delineated using a fish presence/absence model (Fransen et al., 2006), augmented by existing presence/absence survey data. Data attached to other GIS stream data can also be conflated to the synthetic network.

Flow paths are traced from every hillslope DEM cell so that all cells are associated with the channel node they drain to. This provides an explicit linkage between modeled hillslope processes, such as landslide and debris flow runout, and the channels affected by these processes. Collectively, the integrated channel network-terrestrial environment is referred to as a virtual watershed (Barquin et al., 2015; Benda et al., 2015).

The model software implements a hydro-conditioning of the DEM that delineates flow paths out of all closed depressions (Soille, 2004). The DEM itself is not modified, because the original elevation data are necessary to accurately determine channel features. The resulting raster of flow directions provides the information needed for flow routing and creation of the synthetic network. The modeling described below does not require DEMs that were previously hydro-conditioned.

3.2 Delineate Landslide Initiation Sites and Debris Flow Traversal Corridors

Shallow landslides of the type that trigger debris flows tend to occur in particular landscape locations. Landslide initiation locations correlate well with topographic attributes of gradient and specific contributing area, but with contributing area for a DEM cell calculated from within a local radius of the cell. To quantify this correlation, we predict landslide density (number per square kilometer as a measure of susceptibility) as a function of these topographic attributes (Miller and Burnett, 2007).

[13] TerrainWorks has developed and implemented methods to estimate a large variety of attributes; descriptions are available at http://www.netmaptools.org/Pages/NetMapHelp/netmap_tools.htm

The calculated landslide density depends on the number of landslides observed, which varies with the number and magnitude of landslide-triggering storms that occur during the period of observation. Therefore, landslide density is used as a relative measure of spatial variation in susceptibility to landslide initiation. To provide a quantitative measure of susceptibility, landslide density is translated to proportion of landslide occurrences found within any specified area (Burnett and Miller, 2007) (**Figure 3**).

Debris flows tend to scour material and bulk up when traversing steep, confined channels. Debris flow runout length correlates with scoured sediment volume; larger debris flows travel farther (May, 2002). Debris flows tend to lose material to deposition when traversing lower-gradient, unconfined channels and when they change direction at channel junctions (Benda and Cundy, 1990). The probability that a debris flow will reach any point downslope decreases with distance and the rate of decrease is a function of gradient, confinement and changes in channel direction integrated along the flow path (Miller and Burnett, 2008).

From each DEM cell with a calculated landslide density greater than zero, the "*Debris Flow Traversal Areas*"[14] are traced downslope to a fish-bearing channel or until the calculated probability of continued runout goes to zero. If the probability is greater than zero at the intersection of the flow path with a fish-bearing stream, the value is assigned to the originating DEM cell. For all cells along the runout path, this prediction is then used to calculate the probability that a debris flow-initiated upslope traverses the cell and continues to a fish-bearing stream (**Figure 4**). Traversal probability increases as the number and initiation potential of upslope initiation sites increases (**Figure 5**).

The predicted probability of *Debris Flow Traversal Areas* is used to delineate the expected path lengths of debris flows and to estimate the proportion of debris flow length that occurs within a specified range of traversal probabilities. Headwater, non-fish channel corridors are ranked according to the proportion of future debris flow lengths (modified from Burnett and Miller, 2007). For example, from the PFA negotiations, "*Designated Debris Flow Traversal Areas*" include those with a modeled proportion in the upper 50% (**Figure 6**). Over any period, only a portion of these channels will experience debris flows, but those within the 20% bracket should contain 20% of the total debris flow-track length within the basin and these channels should have the highest debris flow-track density (length of debris flow track divided by total length of channels in this bracket). Likewise, channels in the 20-50% bracket should contain 30% of the total debris flow-track length observed in the basin and have a lower debris flow-track density than the 20% bracket, and a higher density than any higher percentage brackets.

As described above, loss of forest cover can increase landslide initiation potential and increase debris flow runout lengths. The influence of forest cover is included in the Miller and Burnett (2007, 2008) landslide-initiation and debris flow-runout models. To characterize debris flow source areas and traversal corridors for the PFA modeling, a uniform mature forest cover is applied. Model outcomes thus focus on the immutable controls of topography on landslide initiation and debris flow runout. Use of mature forest cover also focuses on those forest conditions associated with the lowest landslide susceptibility and the shortest debris flow-runout lengths. These are the conditions sought

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[14] Terms in italics are also used in Chapter 3 of the PFA Report.

with use of riparian and upslope leave-tree buffers. If the models were run with a different forest cover, no forest for example, as long as the applied forest cover is uniform – the same everywhere – model outcomes used for the PFA would vary little because the PFA prescriptions rely on predicted relative rates. If the calculated rates change the same amount everywhere, the relative values remain the same. If the models were run with spatially variable forest conditions, model outputs would change: predicted traversal probabilities would increase, and the associated debris flow corridor, subbasin, and source-area designations would be altered. The degree of alteration would depend on the spatial distribution of forest types. A uniform forest cover was used for the PFA modeling to provide a single delineation of process zones and relative process rates for designing prescriptions, rather than delineations that would vary a bit with each proposed buffer strategy.

The Miller-Burnett models were originally calibrated to the 1996 storm data (Bush et al., 1997; Robison et al., 1999) with topographic attributes derived from line-trace 10-m DEMs. The LiDAR DEMs available now provide much greater accuracy and precision for resolving topographic features. For application to the PFA, the models should be recalibrated using the best-available digital data.

3.3 Ranking Landslide Initiation Areas for Sediment Delivery to Fish-Bearing Streams

Each DEM cell with modeled landslide density and probability of delivery greater than zero (**Figure 6**) is assumed to lie within a potential landslide – debris flow initiation site. The volume of material within a debris flow that travels to a fish-bearing channel is estimated for each potential initiation site. Debris flow volume is assumed to change with travel length through the flow path (starting from the initiation point)[15], increasing through zones with a modeled probability for scour (a function of channel gradient and confinement) and decreasing through zones with a modeled probability of deposition (Miller and Burnett, 2008). The rate of increase is assumed to be proportional to travel length weighted by the probability of scour. The rate of sediment decrease is proportional to travel length weighted by the probability of deposition. The volume deposited in a fish-bearing channel is the volume scoured to that point minus the volume deposited. This represents deposit volume for a single debris flow event.

Estimates of single-event volumes are useful for anticipating the degree to which single events may impact the receiving channel and for ranking source areas in terms of the potential magnitude of those impacts. It is also useful to examine these volumes in the context of the frequency with which the events are likely to occur. Over time, a small-volume event that occurs more frequently may provide as much sediment to the fish-bearing channel as a large-volume event that occurs infrequently. We can expand this perspective to the population of sites across a basin to characterize landslide source areas in terms of the total flux of sediment and wood carried to the fish-bearing network by landslides and debris flows over any increment of time. Frequency of occurrence provides an estimate of the probability that an event will occur within any time interval: if the average frequency for an initiation site is once every 100 years, then the probability of an event in

[15] Lacking data otherwise, we assume the volume per unit length of the initiating landslide is similar to the average volume per unit length available for scour along the runout path.

any year is 0.01. When we look at delivery of sediment to fish-bearing channels over some interval of time – a year, a harvest rotation – from a population of sites, we can translate relative frequency to likely number of events: in any year, or over a harvest rotation, we are likely to see a higher proportion of high-frequency sites triggering debris flows than low-frequency sites. The total flux of sediment and wood to fish-bearing channels within a basin thus depends on both the likelihood of occurrence and the event volume associated with all potential initiation sites. To characterize spatial patterns in the rate at which source areas deliver material to fish-bearing streams, we need to account for both the volume and likelihood of occurrence of a delivering debris flow from each potential initiation site. We do this by multiplying the modeled single-event volume for each site by the estimated probability of landslide occurrence and debris flow delivery in any year, or equivalently, dividing by the recurrence interval. This gives a modeled mean annual volume delivered to the fish-bearing network for each initiation site. We can then rank initiation sites in terms of their likely contribution to the annual basin-wide supply of sediment and wood by debris flow to the fish-bearing channel network.

The volume deposited in the fish stream is thus translated to an average annual volume by dividing it by the estimated recurrence interval of the debris flow depositional event. This average annual volume is then assigned to the originating DEM cell. The recurrence interval is a function of the modeled landslide density and runout probability and is therefore assumed proportional to the calculated probability of traversal. Intervals are typically on the order of centuries to millennia for an individual initiation site (Benda and Dunne, 1987; Montgomery et al., 2000; Reneau and Dietrich, 1991). Traversal by debris flows through downslope channels may occur considerably more frequently, because these channels receive debris flows from multiple upslope initiation sites, so recurrence intervals for debris flow deposition in valley-floor streams may be considerably shorter: decades to a couple of centuries. The constant of proportionality relating probability of traversal to a recurrence interval was set so that the average estimated recurrence for debris flow deposition at 2nd- and 3rd-order channel junctions matched those estimated from other studies (Lancaster et al., 2010; May and Gresswell, 2004) (**Figure 7**).

The average annual volume is summed across all DEM cells in potential initiation sites (with delivery to fish streams) within specific non-fish headwater catchments called "*Designated Debris Flow Traversal Areas*". These subbasins are associated with the predicted highest 20% *Debris Flow Traversal Areas* (**Figure 8**). This gives a modeled mean annual material flux by debris flow to fish-bearing channels for each *Debris Flow Traversal Area Subbasin*. DEM cells within potential initiation sites in each subbasin are ranked according to the modeled, time-averaged mean annual delivered volume. A cumulative distribution is created by summing the ranked values, from smallest to largest. The value for each DEM cell thus indicates what proportion of cells within the subbasin have smaller time-averaged mean annual delivered volumes, or what proportion have larger volumes by subtracting from one. This ranking thus delineates zones within each *Debris Flow Traversal Area Subbasin* in terms of the proportion of the total modeled mean annual sediment volume carried by debris flows to the fish-bearing channel at the base of the subbasin. These zones are referred to as "*Sediment Source Areas*".

For the negotiated PFA prescriptions, *Sediment Source Areas* that contribute the highest 33% of the proportion of time averaged delivered sediment from each *Debris Flow Traversal Area Subbasin* to fish streams, and are greater than ¼ acre in size, are further classified as "*Designated Sediment Source Areas"* (**Figure 9**).

The *Designated Sediment Source Areas* are further delineated to identify those zones within them having the highest modeled susceptibility to initiation of delivering debris flows. This susceptibility is calculated in a manner similar to the ranking of source areas by modeled delivered volume (following the methods described in Burnett and Miller, 2007): the product of modeled landslide density and delivery probability is calculated for each DEM cell in the *Designated Sediment Source Area*. This gives the spatial density of initiation sites for landslides that can trigger debris flows that travel to the fish-bearing stream at the mouth of the subbasin. DEM cells are then ranked from low to high density, the density values are summed to obtain a cumulative distribution, and the distribution is divided by the total. The resulting values delineates zones, ranked by potential for initiation of a delivering landslide, in terms of the proportion of all delivering debris flows originating from within each *Designated Sediment Source Area*. The zones containing the most susceptible fifth (20%) of these initiation sites are referred to as *Trigger Sources* (**Figures 9 and 10**). These *Trigger Sources* are used to differentiate sensitivity to logging within *Designated Sediment Source Areas* during harvest unit layout.

4.0 Summary

To summarize, the models are used to identify two process zones and to rank those zones in terms of process rates:

1. ***Debris Flow Traversal Areas***. These are headwater channels with a modeled probability of traversal by a debris flow originating upslope that continues to a fish-bearing stream downslope. Flowing water through these ephemeral channels generally lack the transport capacity to move the sediment and wood that falls into them, so this material accumulates over time until picked up by a debris flow. Riparian zones along these corridors are thus source areas for wood carried by debris flows to fish-bearing streams. Over any period of time, only a portion of the identified debris flow traversal corridors will be traversed by a debris flow; the corridors are ranked by the modeled probability that they will be traversed. This probability is expressed in terms of the proportion of the total debris flow-track length included within any subset of the corridors, starting from those with the greatest probability of traversal. This measure provides a physical quantity with which to interpret and test model predictions: 20% of observed debris flow track length should lie within those channels ranked from zero to 20%; 50% of the track length should lie within those ranked from zero to 50%, and so on. The modeled proportion is related to the relative frequency of traversal: channels in lower percentage brackets experience more frequent debris flows.
2. ***Sediment Source Areas***. The surface area draining to each debris flow traversal corridor is delineated from the confluence of the corridor with a fish-bearing stream. The delineated area defines a subbasin within the much larger 4^{th}-field HUC analysis basin. Within each subbasin, the initiation sites for debris flows that can carry material to the fish-bearing stream at the subbasin mouth are identified. These are the sediment source areas for that subbasin. Ideally, leave-tree buffers intended to prevent increased rates of sediment production will be targeted for those sites from which initiated debris flows will deliver the most sediment; these buffers are intended to prevent increased rates of landsliding caused by timber harvest in those zones. To identify those zones, the source areas are ranked in terms of the proportion of material

carried to the fish-bearing stream originating from each initiation site within the subbasin. The volume of material delivered to the fish-bearing stream varies from year to year; none in most years, a lot in others. Likewise, the volume potentially delivered varies across the source areas; debris flows from some sites are likely to deliver only a small volume, those from other sites can deliver a huge volume. In those years that debris flows occur, the specific sites from which they originate are unknown beforehand, but based on the modeling, it is known which sites are more or less likely to fail. To identify those sites from which increased rates of landsliding will result in the largest increased rate of sediment delivery, we account for both the likely volume of delivered material and the likelihood that a site will fail and trigger a debris flow. To do this, we rank initiation sites in terms of the estimated mean annual volume of sediment delivered: the calculated delivery volume associated with a debris flow event from the initiation site divided by the recurrence interval of delivering debris flows from that initiation site. Summed over all initiation sites within a subbasin, this gives the mean annual volume of debris flow-delivered sediment for the subbasin. The source areas are then delineated into zones based on the proportion of the mean annual total volume originating from within each zone, ordered from highest mean-annual volume to lowest.

Based on relative process rates estimated with the models, the PFA prescriptions identify four specific zones:

1. ***Designated Debris Flow Traversal Areas***. These are the debris flow traversal corridors falling within the greater-than-zero to 50% proportion bracket. According to the current model calibration, these include the headwater channels with the highest probabilities of debris flow traversal and should contain half of the total track length of debris flows that reach fish-bearing streams within the analysis basin (4th-field HUC) over some monitoring period.

2. ***Debris Flow Traversal Area Subbasin.*** Those subbasins draining to *Designated Debris Flow Traversal Areas* in the top 20% bracket are identified as *Debris Flow Traversal Area Subbasins*. These subbasins feed the top-ranked traversal corridors and are therefore expected to produce delivering debris flows more frequently than subbasins feeding lower-ranked corridors.

3. ***Designated Sediment Source Areas***. Within *Debris Flow Traversal Area Subbasins*, the sediment source area zones that contribute the highest 33% of the proportion of mean annual delivered sediment and are greater than ¼ acre in size are classified as "*Designated Sediment Source Areas"*.

4. ***Trigger Sources.*** The *Designated Sediment Source Areas* are typically located high in the headwalls of the *Debris Flow Traversal Area Subbasins*, just below the ridge-top landings used for cable yarding of logs out of these subbasins. Leave-tree buffers in these source areas can block access to a large portion of the subbasin, so it is expected that yarding corridors might be placed through some *Designated Sediment Source Areas*. The *Designated Sediment Source Areas* have already targeted those zones where timber harvest would have the greatest expected impact on the rate of sediment delivery out of the subbasin by debris flow, but there is still variability in susceptibility to increased rates of landsliding within these zones. *Trigger Sources* are delineated to identify those *Designated Sediment Source Areas* with the greatest expected sensitivity to tree removal so that needed yarding corridors can be placed through less sensitive zones.

Susceptibility to increased rates of landslide initiation and associated debris flow delivery is based on modeled variability in the spatial density of delivering landslide initiation sites solely within the set of *Designated Sediment Source Areas* in a subbasin. Those *Designated Sediment Source Area* patches containing the top 20% of the initiating sites within all patches in the subbasin are flagged as *Trigger Sources* to flag those most sensitive to placement of yarding corridors.

This set of methods incorporates three key factors for providing information to guide development of forest practice prescriptions in landslide-prone terrain:

1. The linkages between upslope zones of landslide initiation and downslope zones of deposition are explicitly recognized and quantified. The potential for debris flow delivery of material to a fish-bearing stream is calculated for every potential initiation site and the potential for traversal by a debris flow that travels to a fish-bearing stream is calculated for every non-fish channel. Upslope source areas for landslides and debris flow corridors can be ranked by both the potential for landslide initiation and the potential for delivery to a downslope resource.
2. The interaction of all initiation sites and runout zones are explicitly recognized and quantified. A single depositional site in a fish-bearing stream may receive debris flows from dozens of upslope initiation sites. The calculated probability for debris flow traversal of a non-fish channel and deposition in a fish-bearing channel represents the cumulative potential of all upslope initiation sites and runout paths.
3. Results of these linked models are testable. The models predict where a certain proportion of landslide-initiation and debris flow-depositional events will occur. In an adaptive-management context, these methods can be tested and improved using data obtained by monitoring of landslide and debris flow events over time.

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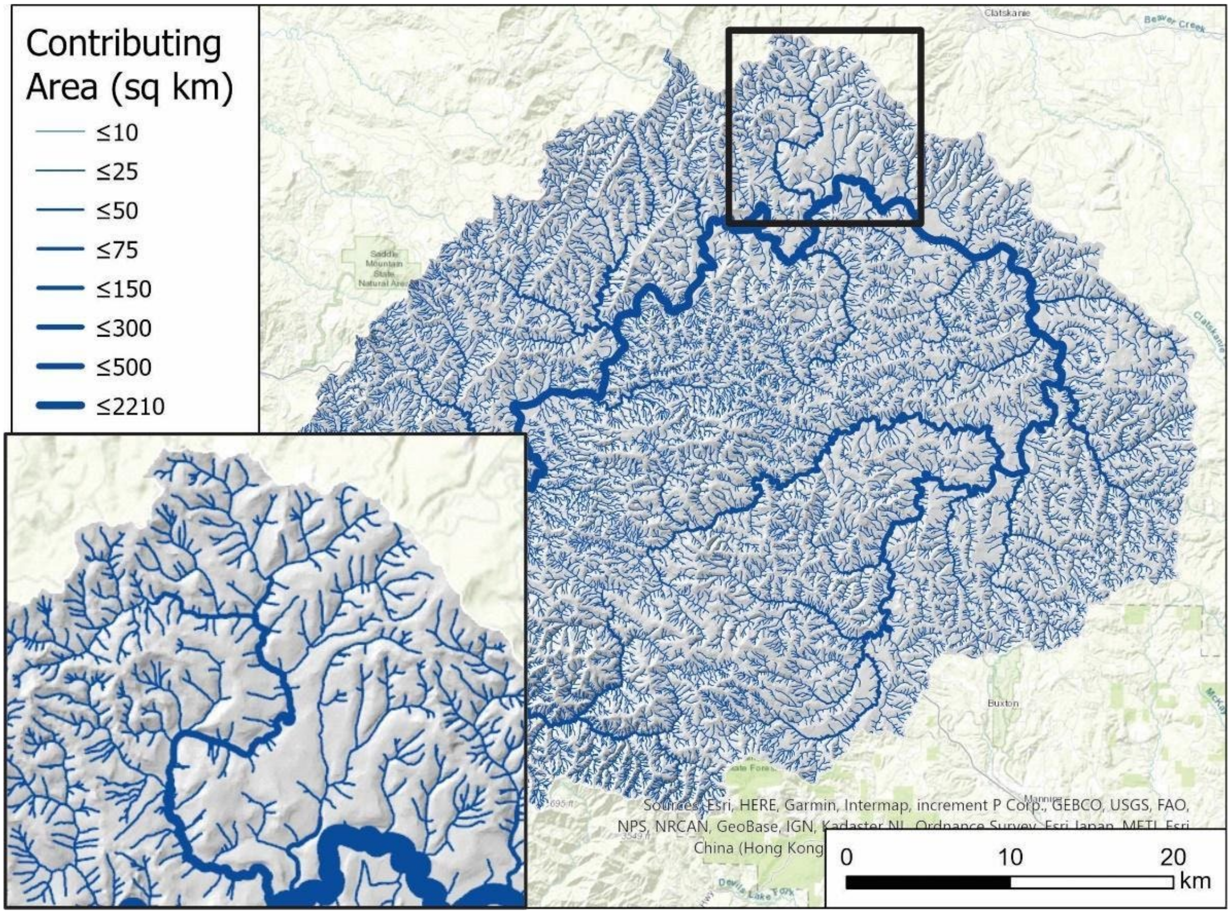

Figure 1. A synthetic stream network is shown for the Nehalem River watershed in northwest Oregon.

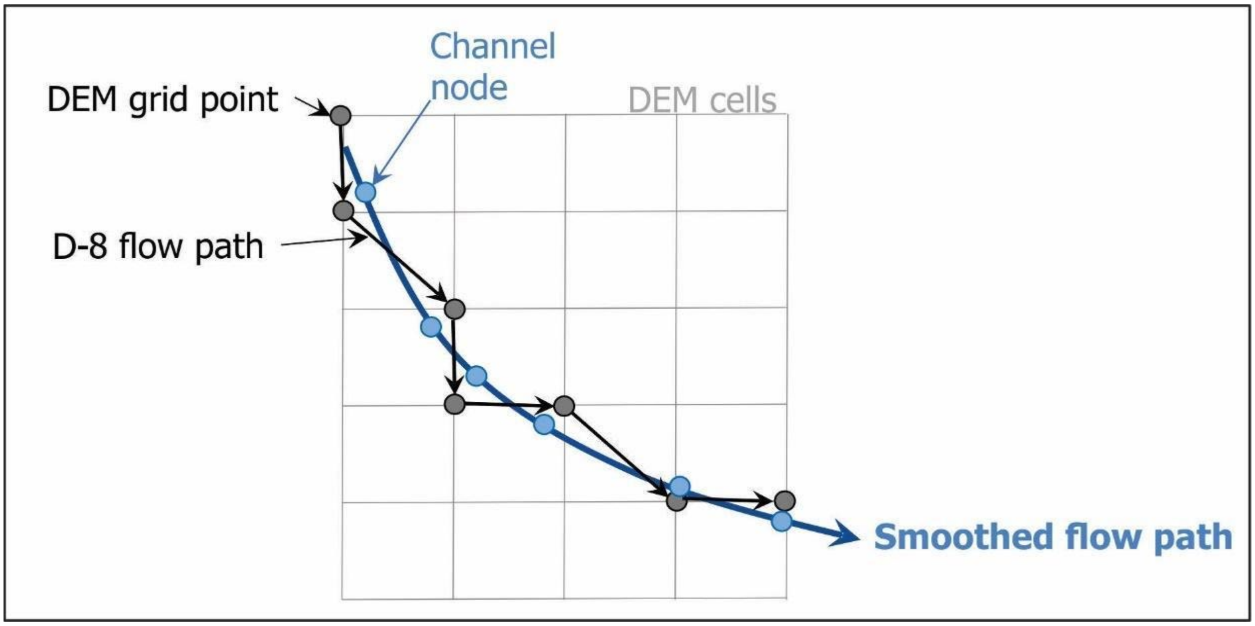

Figure 2. A digital channel network is typically represented in a GIS (Geographic Information System) as a set of connected lines (arcs). Each arc can be assigned a set of attributes, such as channel size and gradient, etc. In the FPA analysis, a synthetic channel network is represented as a set of linked nodes; one node for each DEM grid point traversed by each channel.

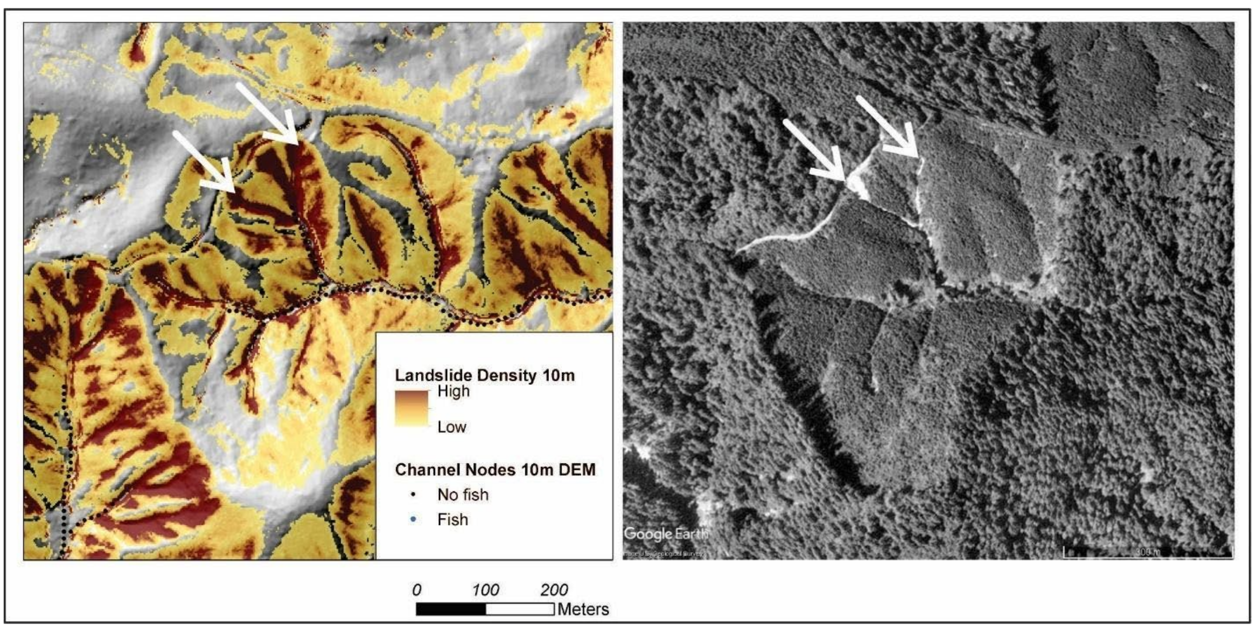

Figure 3. Landslide density (#/km^2) varies with topographic attributes in a coastal Oregon watershed. Topographic locations associated with landslide occurrences have a high density. Example shown is from the central Oregon Coast Range.

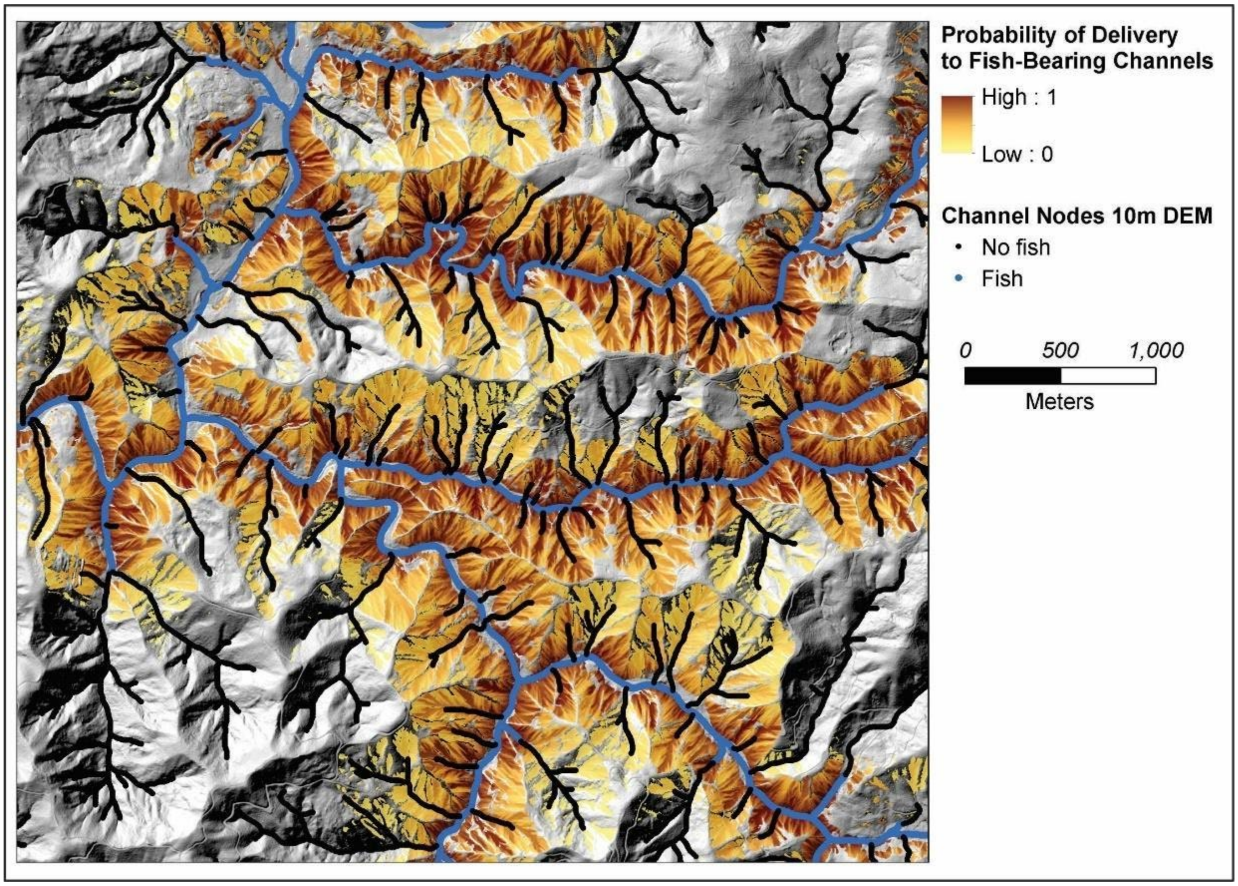

Figure 4. Probability of sediment delivery is calculated for each DEM (2m LiDAR) cell.

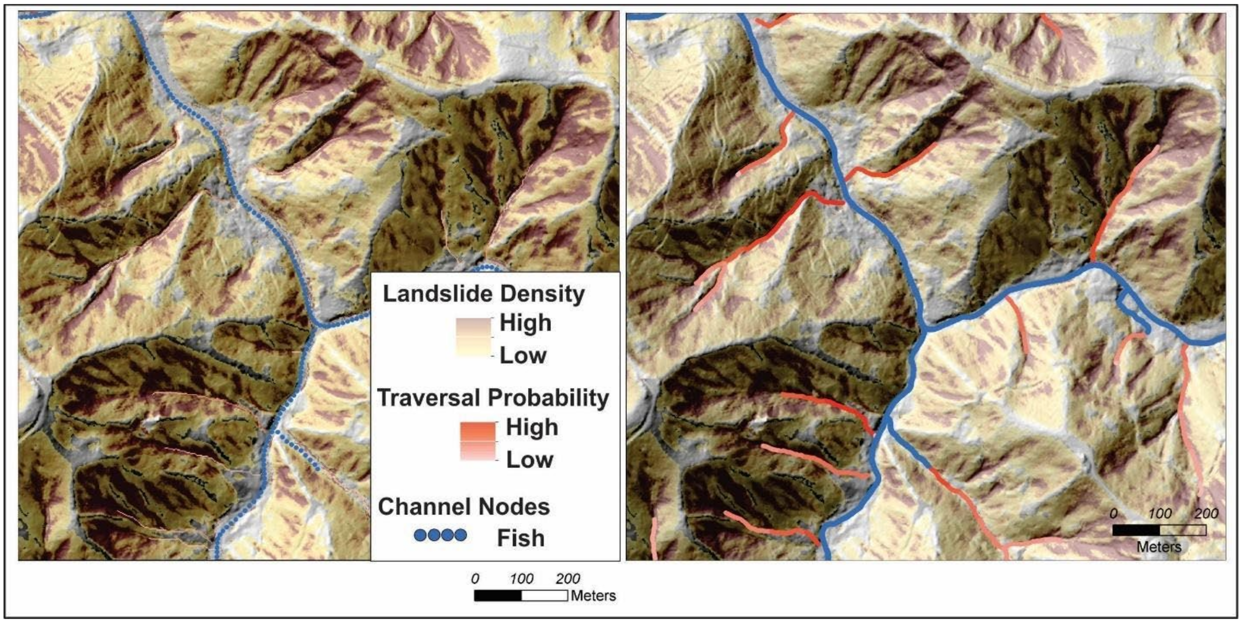

Figure 5. Predicted landslide density (left) and debris flow traversal probability for an area in the Oregon Coast Range using 2m LiDAR DEMs. Flow paths with high probability of being traversed en route to a fish-bearing channel show up as thin red lines. (right) Predictions overlayed onto synthetic stream network; blue lines are fish-bearing channels.

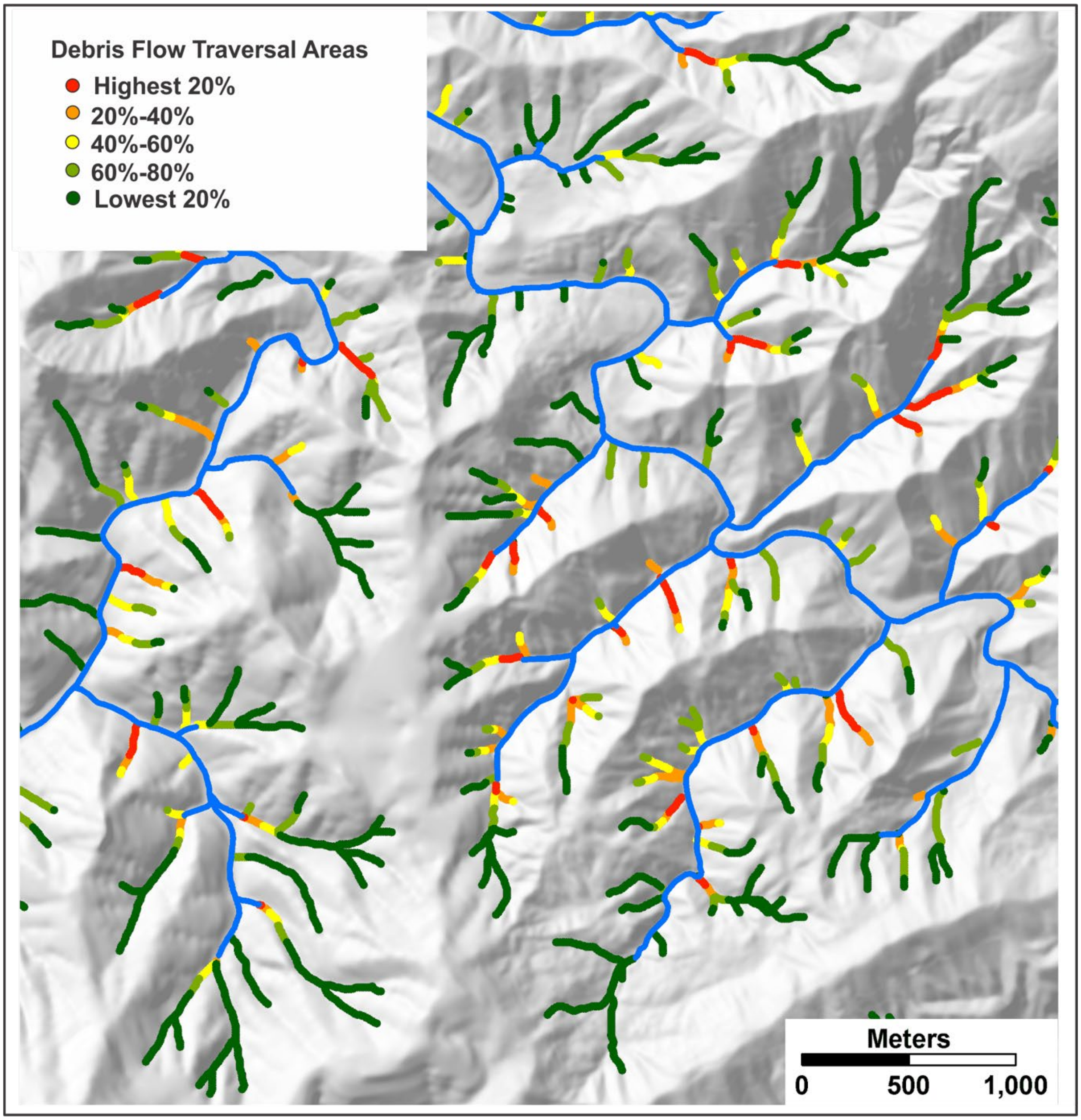

Figure 6. Model predictions of non-fish channels showing proportion of future debris flows that travel to fish streams (*Debris Flow Traversal Areas*). The inset is a cumulative distribution of Debris Flow Traversal Area proportions.

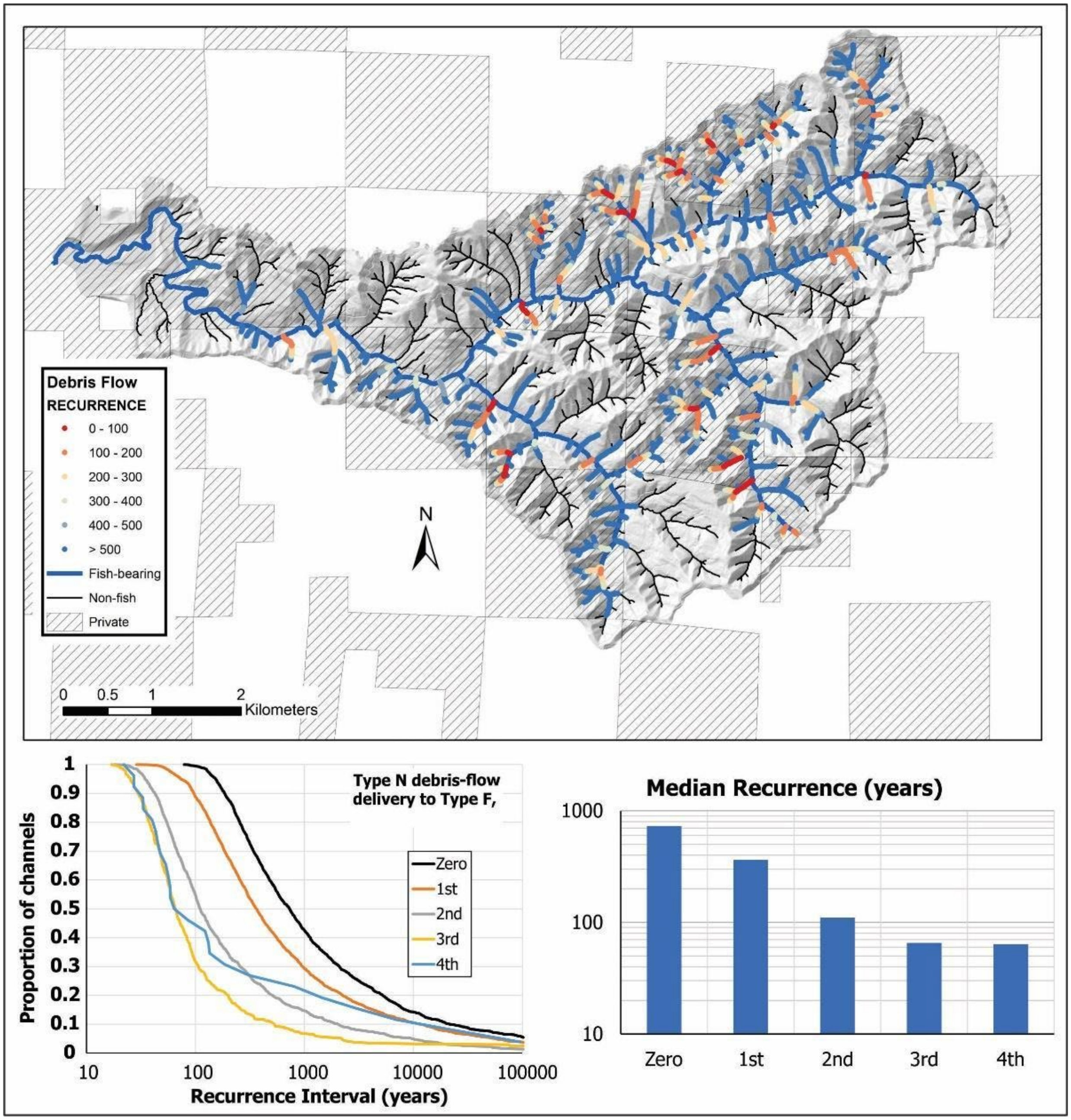

Figure 7. Predicted recurrence intervals of landslides (zero-order) and debris flows in first- through fourth-order channels for a subbasin in the central Oregon Coast Range (Miller, in prep.).

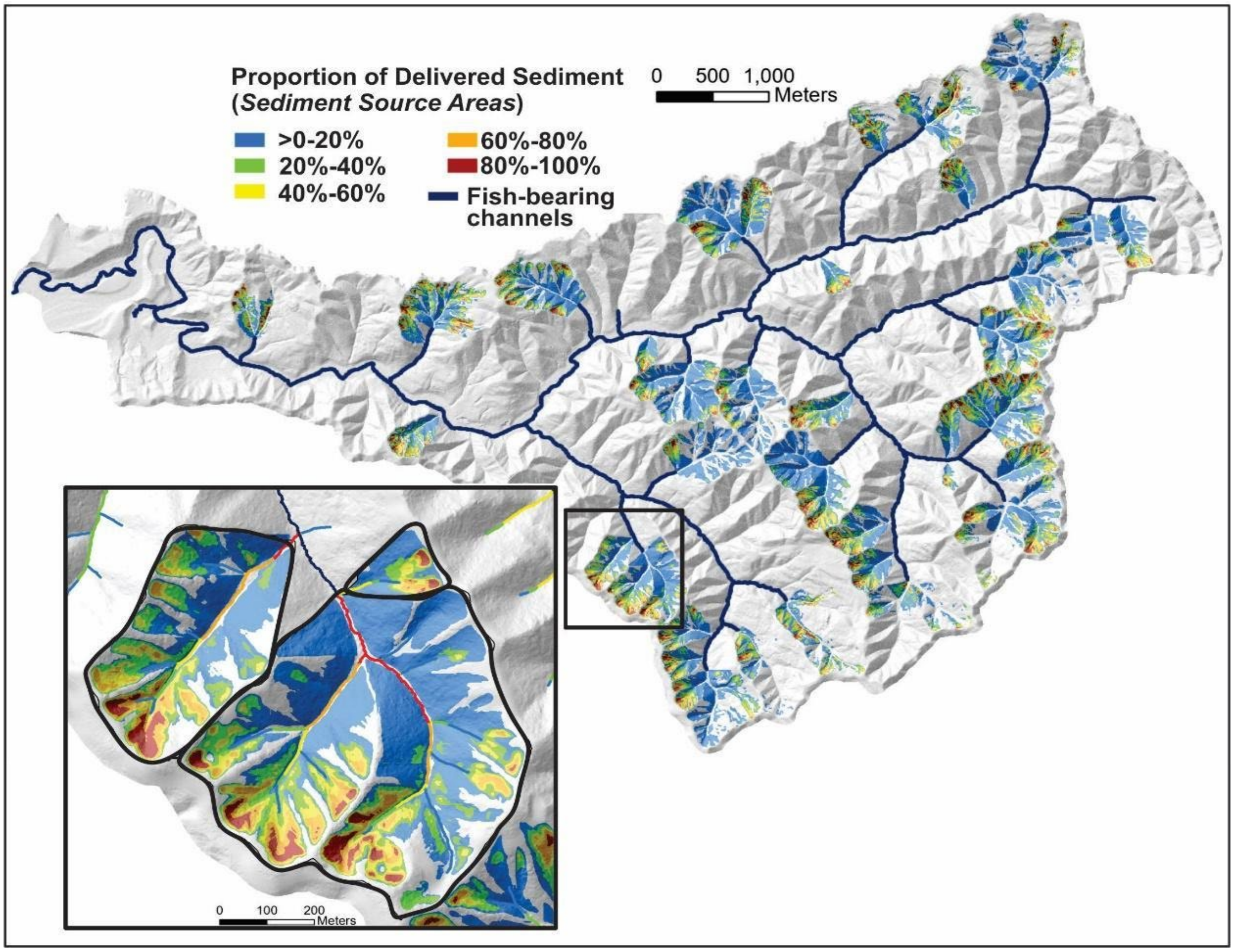

Figure 8. Predicted *Sediment Source Areas* are ranked for debris flow sediment scoured from non-fish channels that deposit into fish-bearing channels specifically for those subbasins that are associated with the highest 20% Debris Flow Traversal Area Subbasins.

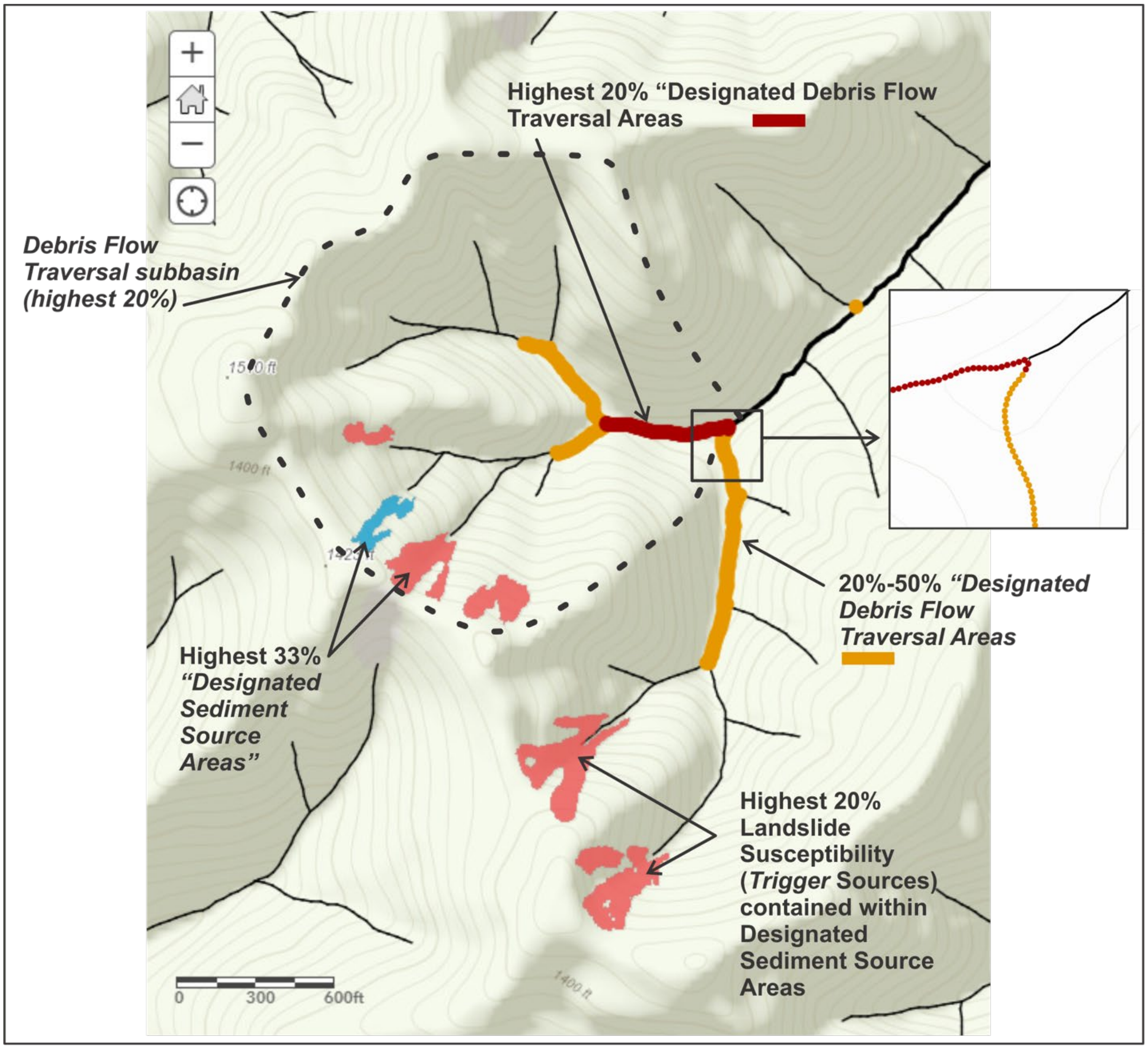

Figure 9. The highest 20% and 20-50% *Debris Flow Traversal Areas* are shown by red and orange channels. The *Debris Flow Traversal Area* *__Subbasins__* circumscribe the highest 20% *Debris Flow Traversal Areas* (dashed line). Within these specific subbasins, the highest 33% of *Sediment Source Areas* greater than ¼ acre in size are classified as *Designated Sediment Source Areas*. They are indicated as blue and coral polygons. The coral polygons indicate the highest 20% of landslide susceptibility and debris flow volume (*Trigger Sources*). (see Figure 10).

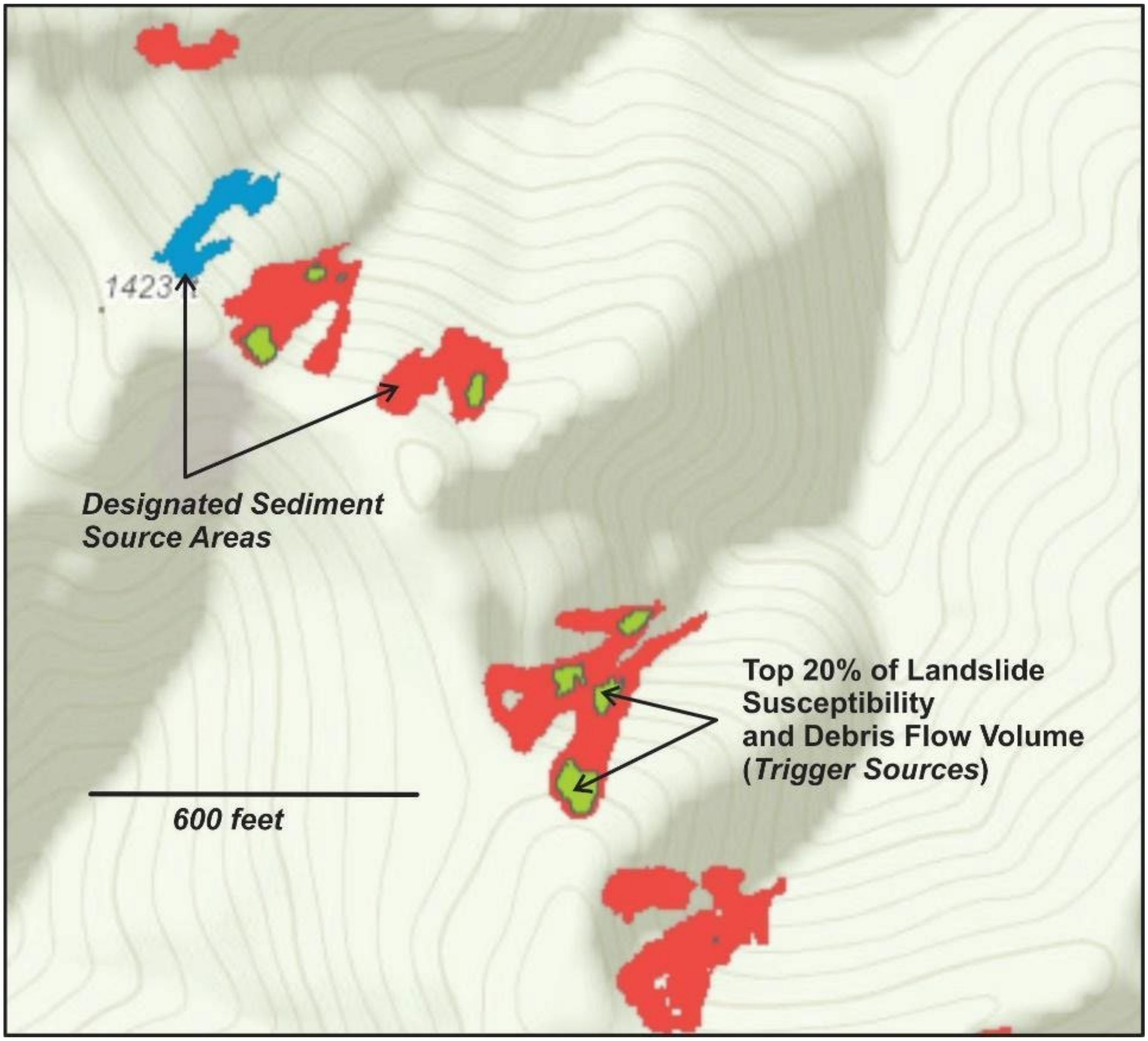

Figure 10. Depiction of designated Sediment Source Areas (blue, coral polygons) showing the highest 20% landslide susceptibility (*Trigger Source*) areas (green).

APPENDIX C: GUIDANCE FOR IDENTIFICATION OF SLOPE RETENTION

Appendix C. Guidance for Identification of Slope Retention Areas from Designated Sediment Source Areas

1.0 Scope

The approach for identifying Slope Retention Areas from model-derived Designated Sediment Source Areas using remote screening tools and field criteria by trained personnel.

1.1 Introduction

The current standard of practice in the Pacific Northwest for identifying landslide hazards and risks associated with proposed forest practices is to couple remote screening and field information. Remote screening traditionally relies on existing air-photo and map-based information to characterize various landforms and other criteria that are correlated with landsliding (e.g., rock type, soil properties, topography, and precipitation). More recently, such information has been synthesized into empirically calibrated computer models designed to identify potentially unstable slopes. Landforms and other criteria generally serve as proxies for mechanistic parameters (e.g., soil strength, soil depth) and groundwater conditions that control landslide initiation but that cannot be readily observed or evaluated directly over large areas. At the harvest unit scale, field reconnaissance is an important component because some landform boundaries and other relevant features may not be conclusively resolved by a model or remote sensing data. Field protocols typically include observation of topographic, hydrologic, and vegetative indicators of past and potential future slope instability.

For the Private Forest Accord, the Authors agree that outputs of the TerrainWorks model will provide the initial remote screening. The model identifies Designated Sediment Source Areas. From these, 50% will be selected as Slope Retention Areas based on an office screen and a field evaluation. ODF will develop a Technical Note and train (and document the training of) landowner representatives and ODF field personnel to apply the office screen and conduct the field evaluation, including recognizing numeric or narrative geomorphic criteria and field indicators necessary to complete final harvest plans.

This guidance is intended to apply to rules developed in the context of the Private Forest Accord and is not a substitute for regulations, rules, and guidance that apply to the identification of high landslide hazard locations for public safety purposes.

1.1.1 Audience

Landowner representatives, such as foresters, forest engineers, and other field personnel tasked with identifying Slope Retention Areas, where timber harvest is prohibited, from model-identified Designated Sediment Source Areas.

1.1.2 Context

Concern about unstable slopes on private forest lands in Oregon dates to 1982 (Spiesschaert et al., 1982). Forest landowners have been identifying certain landforms for 35+ years in Oregon, Washington, and British Columbia (Chatwin et al., 1994). Over this time, numerous documents have been published that describe unstable landforms specific to the geomorphic history of a given region as well as topographic, hydrologic, and vegetative field indicators of potential or existing slope instability that are common across regions. A partial list is included in section 1.2.1 of this Appendix.

1.1.3 Terminology

Headwalls are clearly identifiable concave-shaped slopes (as seen along the slope contour on the ground surface) that can concentrate water to increase landslide susceptibility. These are steep, unchannelized areas with a strong convergent slope form that are situated at the head of drainages. Headwalls are also referred to as bedrock hollows (in Washington), gullies (in British Columbia), colluvial filled hollows, zero-order basins, and swales. Landslides occurring in these locations are more likely to move as channelized debris flows than landslides that initiate in other areas of the slope (*See* ODF 2019, ODF 2003).

As indicated below, slope gradients consistent with the headwall component of ODF High Landslide Hazard Location Criteria (ODF Technical Notes 2 and 6, *See* ODF 2019 and ODF 2003) will be used.

1.2 Steps for Delineating Slope Retention Areas

Basic steps and field criteria are described below for mapping Slope Retention Areas from Designated Sediment Source Areas. See Chapter 3 of this Report for definitions. Figure 1 provides landform examples.

a. Step 1: Office screen

Use the map of Designated Sediment Source Areas generated by the TerrainWorks model ("Delineating Landslide and Debris Flow Susceptibility in Western Oregon in Support of the Private Forest Accord," TerrainWorks 2022). The mapped Designated Sediment Source Areas represent potential landslide initiation sites that contribute the highest 33% of the proportion of delivered sediment to a designated subset of Type F and Type SSBT streams and are greater than ¼ acre in size. The Designated Sediment Source Areas are further divided into those that contain modeled Trigger Sources, as described (TerrainWorks 2022). Those with Trigger Sources, which are the most susceptible fifth (20%) of sites likely to initiate a high-volume debris flow that delivers to a Type F or Type SSBT stream, are shaded red[16]. Those without Trigger Sources are shaded blue[2].

Within each harvest unit, choose at least half (50%) of the Designated Sediment Source Areas as potential Slope Retention Areas, where timber harvest will be prohibited. Selection should prioritize Trigger Sources (red) over non-Trigger Sources (blue) and larger Designated Sediment Source Areas over smaller ones. These should be distributed throughout the harvest unit consistent with safety, environmental, and operability concerns. Yarding, which may require cutting, but not removal, of trees, is permitted only through Slope Retention Areas that do not contain Trigger Sources, but the number, size, and location of yarding corridors shall be designed to minimize soil and vegetation disruptions that may increase slope instability. Results of this office screen are the Designated Sediment Source Areas to receive a field evaluation and final identification as Slope Retention Areas.

b. Step 2: Field evaluation

In the field, the presence of headwalls **within** a potential Slope Retention Area should be identified. This identification is determined based on narrative (e.g., slope form) and numeric (e.g., slope gradient) geomorphic criteria. Gathering of subsurface information (e.g., soil depth, soil strength, etc.) is not required for determination. Traverse and locate the boundaries of the headwall. These may often be inferred from surface, geomorphic, and vegetative indicators. Headwalls most likely to initiate a shallow, rapid landslide in Western Oregon are steeper than 70 percent, except in the Tyee Core Area, where the headwall is steeper than 65 percent. Measurement should be along the steepest portion of the slope. Clinometers do not give precise slope readings, so when slopes just under the

[16] Colors that appear on final FERNS maps may be different than indicated here.

threshold criteria are measured with a clinometer, these may in fact be areas of concern. Once any headwall is mapped, adjust the boundary of the Slope Retention Area to ensure the headwall is encompassed.

Other field indicators (topographic, hydrologic, and vegetative) as identified in Table 1 can be used to further refine the boundary of a Slope Retention Area to incorporate any other unstable areas. No single field indicator necessarily defines the precise boundary of a Slope Retention Area, but a combination of several can help in delineating a boundary.

Windthrow may be a factor contributing to shallow, rapid landslides. The Operator should consider the wind firmness of trees that are to be left in a Slope Retention Area. Thus, the boundary of a Slope Retention Area may need to be extended to reduce windthrow hazard to retained trees. Crown and bole characteristics, exposure to prevailing storm winds, topographic effects, relative height of trees, and species mix (conifer/hardwood) should be evaluated when determining the boundary of a Slope Retention Area.

Field evaluation may identify safety or ecological impact concerns not present during office screening that may require choosing a different Designated Sediment Source Area as a Slope Retention Area and documenting that decision. Where safety or increased risks to Type F or Type SSBT streams warrant, landowner representatives may select smaller Designated Sediment Source Areas or those Designated Sediment Source Areas without Trigger Sources instead of the standard priorities. Eligible concerns that may warrant selection of non-priority areas to satisfy the minimum 50% Designated Sediment Source Area requirement are that priority areas would: 1) clearly reduce worker safety; or 2) increase ecological impacts resulting from, for example, additional road or landing construction, excessive sidehill yarding, or other yarding practices.

c. Step 3: Apply the appropriate prescription

Once any Slope Retention Area has been thoroughly assessed and the boundaries clearly marked in the field, a written plan must be submitted containing at a minimum:

- Unit map where timber harvesting will occur, including
    - those portion(s) of the operation containing Designated Sediment Source Areas, with Trigger Sources identified, and which of these have been selected as Slope Retention Areas;
    - Identification of those Designated Sediment Source Areas that are eligible for yarding corridors.
- The rationale for selecting specific Slope Retention Areas, including that for choosing non-priority areas to satisfy the requirement of retaining a minimum of 50% of the Designated Sediment Source Areas;

- A map of yarding corridors and documentation that these were designed to minimize impacts;

- Additional information related to the operation, as required or requested by the State Forester.

In summary, the steps for delineating Sediment Retention Areas are as follows:
1. *Refer to FERNS map for Designated Sediment Source Area(s)(DSSA) (blue and red polygons) for the proposed harvest unit.*
2. *Select at least 1/2 of the DSSA (if more than one) for further investigation. Prioritize red (Trigger Areas) over blue polygons, larger over smaller.*
3. *Identify headwalls* **within** *the DSSA chosen above, i.e., the potential Slope Retention Areas.*
4. *In the field, identify headwalls and flag final boundaries of Slope Retention Areas.*
5. *Prepare a written plan summarizing application of these steps.*

1.2.1 Field Indicators for Delineating Slope Retention Areas

Topographic indicators
- Steep (>70% gradient) slopes with strong convergence near ridge tops and swales that are unchannelized, commonly spoon-shaped, typically 50-100 feet wide. Usually terminates where distinct channels begin. Convergence should indicate potential for significant concentration of groundwater within the headwall before reaching a defined channel.
- Bare or raw, exposed, non-vegetated soil on steep slopes. This condition may mark the location of a debris flow, or the headwall or sidewall of a slide or evidence of active movement.

Hydrologic indicators
- Seepage lines or spring and groundwater piping. These conditions often mark the contact between high permeability and low permeability soils.

Vegetative indicators
- Split trees and split old growth stumps. These may be associated with tension cracks.
- Hydrophytic (water-loving) vegetation (skunk cabbage, devil's club, salmon berry, etc.) on slopes. These conditions may indicate the presence of groundwater seeps and associated hydrogeologic conditions.
- Patterns of disturbed vegetation such as changes in stand composition (early seral stage or lack of mature trees within a hillslope) or small groupings of alder in a conifer-dominated forest may indicate recent or historic slope failure.

1.3 Literature Cited

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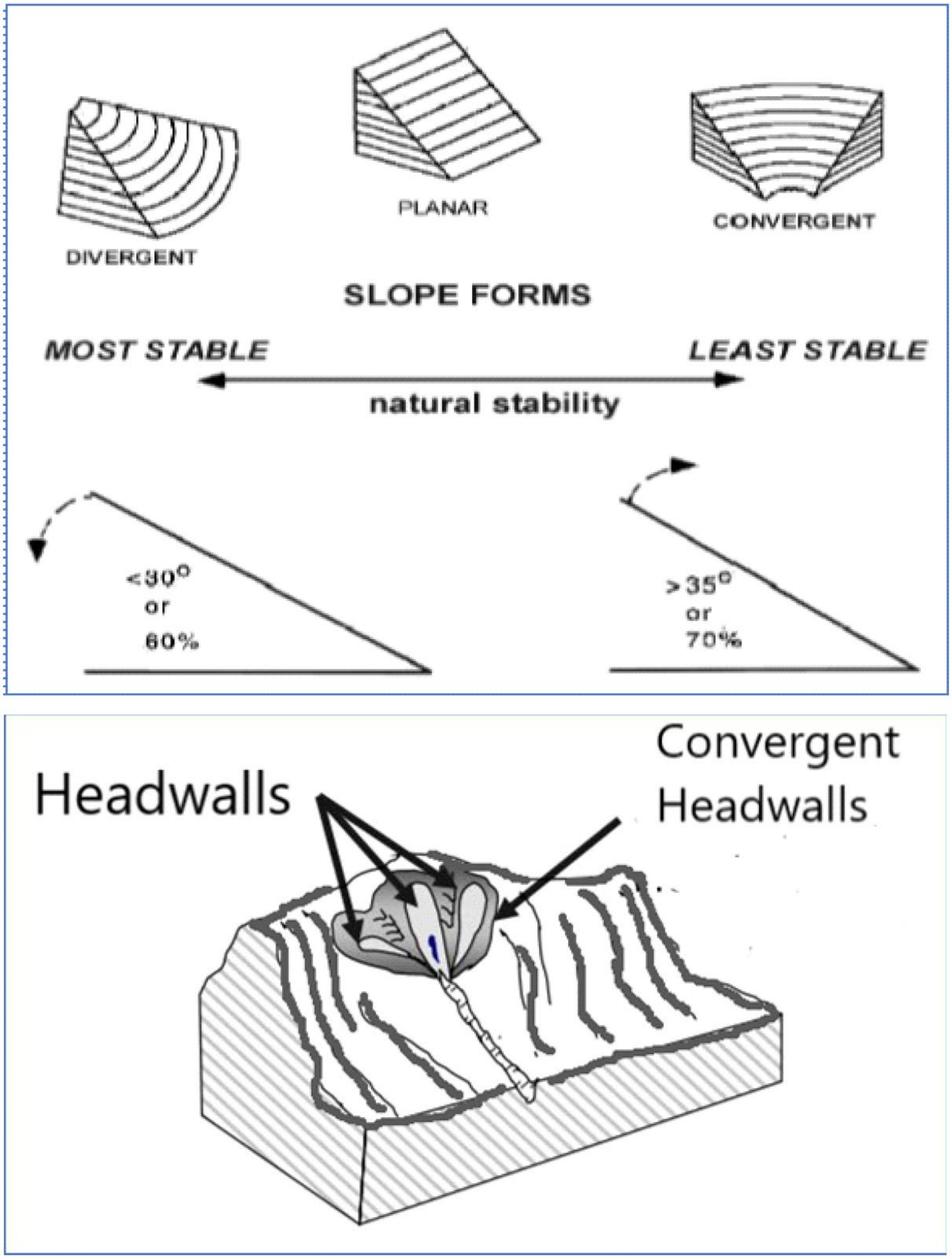

Headwalls and Convergent Headwalls illustration. Modified from Figure 8, page 16-15, WDNR Forest Practices Board Manual, Section 16, Guidelines for Evaluating Potentially Unstable Slopes

Figure 1.

APPENDIX D: FOREST CONSERVATION CREDIT

Appendix D. Forest Conservation Credit

The Forest Practice Act regulations to be adopted as part of the Private Forest Accord (PFA) include a Standard Practice for large forestland owners and a Small Forestland Owner (SFO) Minimum Option which regulates timber harvests in subject riparian areas. These forest practices will be incorporated into a Habitat Conservation Plan (HCP) which will form the basis of the application for an Incidental Take Permit (ITP), with the goal of providing regulatory stability and assurances to forest landowners.

To incentivize SFOs to implement the Standard Practice, when an SFO adopts the Standard Practice instead of the SFO Minimum Option, the SFO will become eligible to receive a Forest Conservation Credit (Credit) equal to the Stumpage Value (See "Stumpage Value" below) of the additional timber that is retained in the Forest Conservation Area by adopting the Standard Practice. Additionally, a tax credit may be claimed pursuant to Section 5.3.1.3(a)(2).

The process to request and receive a Forest Conservation Credit will be as follows:

1. To become eligible for the Forest Conservation Credit (Credit), an SFO must file a Notification of Operation (Notice) with the Oregon Department of Forestry (ODF) to conduct an eligible Type 1, 2, or 3 timber harvest (as defined under the Forest Practices Act) adjacent to a qualifying riparian area. To be eligible, the harvest area outside the riparian area must be equal in size or larger than the size of the adjacent Forest Conservation Area (as defined in Chapter 5 of this Report). In the Notice, the SFO must include their intent to adopt the Standard Practice for the Forest Conservation Area in lieu of the SFO Minimum Option.

2. An eligible SFO must request the Credit when filing the Notice. The SFO must provide ODF with adequate documentation of the Stumpage Value of the Timber retained in the Forest Conservation Area (Stumpage Value). The Stumpage Value documentation and related costs under this section can be submitted by the SFO to ODF anytime between the date of Notice and three months after the timber harvest has been completed. The effective date of the Stumpage Value is to be the date of the Notice. The SFO is responsible for providing documentation of the Stumpage Value and related costs to ODF in a timely fashion.

3. If the SFO hires a professional forester to determine Stumpage Value, the cost of the appraisal may be submitted by the SFO to ODF to add to the Credit. If the appraisal costs are added to the Credit amount, they may not be deducted for income tax purposes.

4. ODF will timely evaluate and approve the Stumpage Value, add any related landowner costs as provided in this section, issue the resulting Credit to the SFO, and notify the Oregon Department of Revenue of the existence and amount of the Credit issued to the SFO. The effective date of the Credit is to be the date on which the Notice is filed.

5. Once a Credit has been issued for a particular riparian area, the SFO and any future owners must adopt the Standard Practice in that riparian area for a period of 50 years from the date the Notice is filed. Landowners will not be allowed to remove trees from the Forest Conservation Area, except for reasons of public safety or for personal use (e.g., provision of firewood). Landowners should consult with ODF prior to removing trees from the Forest Conservation Area. To avoid the necessity of obtaining surveys of the affected areas, details of the area subject to the management restriction shall be maintained by ODF in the FERNS system and are not required to be included in any deed restriction except to note that there is a restriction on management for the affected property.

6. ODF will provide the SFO a standardized document suitable for filing with the County noting the management restrictions for the riparian area earning the Credit, the amount of the Credit received that creates the restriction, and the expiration date of the restriction. The SFO is responsible for filing this document with the County where the affected areas are located. The fee for recording the deed restriction with the County will be paid by the SFO but may be submitted by the SFO to ODF to add to the Credit amount. If the recording fees are added to the Credit amount, they may not be deducted for income tax purposes. The restriction will remain with the property if and when ownership is transferred to another.

7. Once issued, the Credit will be a permanent multi-year carry forward tax credit until completely used up by the taxpayer or their heirs.

8. If the SFO is taxed as a trust, partnership, or S corporation, the entity can distribute the Credit to its owners or beneficiaries, as appropriate.

9. The Credit may be used by any taxpayer holding the Credit to offset Oregon Income and Estate Taxes. Any unused Credit becomes part of the taxpayer's estate and is transferrable to the taxpayer's heirs.

10. The taxpayer can apply the Credit to their tax liability in the normal way tax credits are used when filing taxes. It is the SFO's obligation to keep a record of the original Credit, the amount of Credit applied in prior tax years, the amount of Credit being applied on the current return, and the amount carried forward to future years. The taxpayer must retain the records as part of their permanent files and provide the records to the Oregon Department of Revenue upon request.

11. The taxpayer is not required to use the Credit against their tax liability in any given year.

12. The Forest Conservation Credit will not be included in the Sunset Clause for other state tax credits. This is to be a permanent tax credit available to SFOs for the duration of the Incidental Take Permit envisioned by the PFA.

13. If a future legislature cancels the Forest Conservation Credit and does not replace it with a similar compensation option for SFOs, all existing Credits held by taxpayers and the related deed restrictions will be retained. All restrictions on SFOs on using the SFO Minimum Option will be removed for riparian areas where a Credit has not been issued. ODF will continue to track use of the SFO Minimum Option without restrictions of its use. A future legislature could reinstate the Forest Conservation Credit and the system would be renewed.

14. If the SFO who originally applied for and received a Credit wishes to use the SFO Minimum Option or remove the restriction on the property deed for the area receiving the Credit, the taxpayer must repay the State any Credit that has been deducted from their tax liability, with interest from the due date of the original return(s) where the Credit was taken and will forfeit any unused Credit. The interest rate shall be the underpayment rate. The repayment amount could be paid directly to the State or be added to the taxpayer's income tax liability. To make repayment to the State, a form specifically for the purpose of repaying the state for the Credit and the appropriate County so that the restriction can be removed will be developed by ODF. Once the repayment has been made, the SFO will inform ODF that the harvest restriction related to the Credit has been removed. ODF will modify the information in FERNS to reflect there is no longer a restriction on that particular riparian area. The SFO will contact the County with the document and the restriction will be removed. SFO will pay recording fees.

15. If a subsequent SFO owner wishes to use the SFO Minimum Option or remove the County restriction from the deed in a riparian area because of a previous owner's actions, the SFO must repay the State for the original amount of the Credit received by the previous owner with

interest from the date of acquisition of the property. The interest rate shall be the underpayment rate. The repayment amount can be paid directly to the State or be added to the taxpayer's income tax liability. To make payment to the State, a form specifically for the purpose of repaying the State and appropriate County that the restriction can be removed will be developed by ODF. Once the repayment has been made, the SFO will inform ODF that the harvest restriction related to the Credit has been removed. ODF will modify the information in FERNS to reflect there is no longer a restriction on that particular riparian area. ODF will provide the SFO with a document to be presented to the appropriate County to remove the restriction. The SFO will contact the County with the document and the restriction will be removed. SFO will pay recording fees.

16. Should an SFO intentionally harvest in a riparian area where a Credit has been issued and a deed restriction prohibits such harvest, the SFO will be in violation of the Forest Practices Act (FPA) and vulnerable to penalties for such FPA violation. If the SFO originally requested and received the Credits and some Credits have already been used, the SFO must repay the State any Credit that has been deducted from their tax liability from the due date of the original return(s) where the Credit was taken and will forfeit any unused Credit. The interest rate shall be the underpayment rate. If the SFO acquired the property with the deed restriction identifying the Credit value and restricting harvest in the relevant riparian area, the SFO must repay the State for the original amount of Credit received by previous owner from the date of acquisition of the property. The interest rate shall be the underpayment rate. To make payment to the State, a form specifically for the purpose of repaying the State and appropriate County that the restriction can be removed will be developed by ODF. Once the repayment has been made and the SFO has paid any penalties for violating the FPA, the SFO will inform ODF that the harvest restriction related to the Credit has been removed. ODF will modify the information in FERNS to reflect there is no longer a restriction on that particular riparian area. ODF will provide the SFO with a document to be presented to the appropriate County to remove the restriction. The SFO will contact the County with the document and the restriction will be removed. The SFO will pay recording fees.

Special Assessment Determinations – A forest conservation area for which a credit is allowed under this section may not be disqualified from eligibility for the special assessment as forestland solely due to the use of the credit allowed under this section and shall remain eligible for any deferral that they would otherwise be eligible for. Additionally, these lands shall be classified as land class FX.

Determining Stumpage Value – Stumpage Value is the value of standing timber based on the value that would be received if those trees were harvested and delivered to mills minus the costs of delivering those logs to those mills. The SFO will determine the Stumpage Value of timber not harvested when using the Standard Practice instead of the SFO Minimum Option. First, the SFO will determine the volume, by species and log grade for the timber to be credited for the Forest Conservation Credit using standard methods used by professional foresters. Professional forester is defined in ORS 674.100 (2)(f). Once the volume of timber by species and log grades is determined, the SFO will determine the Stumpage Value using methods used by professional foresters, such as the Conversion Return Stumpage Value Method, the Actual Comparative Stumpage Value Method, or Cash Flow Model Method.

Conversion Return Stumpage Value Method – Conversion Return Stumpage Value Method begins with the volume of timber to be retained, which is determined by species and log grades using standard measuring techniques and procedures used by professional foresters. Then, to determine Stumpage Value, take the delivered log value by species and log grades from current log price information for the area in which the timber is ordinarily sold and deducting the total costs of marketing and delivering the logs to the mills. This will determine the Stumpage Value of the standing timber to be retained.

Actual Comparison Stumpage Value Method – The Actual Comparison Stumpage Value Method can be used when the timber being retained is similar to the timber being harvested in the timber harvest associated with the Retention Tax Credit request. It begins with determining the volume of timber to be retained by species and log grades using standard measuring techniques and procedures used by professional foresters. The Stumpage Value is then calculated using the actual average revenues minus costs of logs sold by species and grade from the adjacent harvest area.

Cash Flow Modeling Method – Determining the Value of standing timber by measuring the projected volume of the stand over a harvest rotation based on species and site class, determining the Stumpage Value of the stand at harvest age then discounted that value to the present with an appropriate interest rate.