2. ALTERNATIVES INCLUDING THE PROPOSAL

2.1 INTRODUCTION

This chapter describes and compares the alternatives under consideration by the Forest Practices Board, including the proposed action. The first section describes the process followed to formulate the alternatives. The next section describes the alternatives that were considered but eliminated from detailed study. This section is followed by a description of the alternatives considered in detail. A comparison of the alternatives, including how each alternative addresses the significant issues, is the final section in this chapter.

2.2 ALTERNATIVE DEVELOPMENT

In response to imminent listings of several salmon species in Washington under ESA, as well as new information indicating that riparian protection was not adequate, the timber, fish, and wildlife (TFW) participants reconvened in 1997 to develop a comprehensive plan to address salmon and other aquatic species on forest lands (see Section 1.2). Representatives from federal agencies and counties also joined the TFW participants. After several months of negotiation, representatives of environmental interests withdrew from negotiations.

The resultant approach is summarized in the Forests and Fish Report (April 29, 1999). This approach is based upon agreement among five of the six caucuses including some Tribes, landowners, and local, state, and federal agencies. The Forests and Fish Report environmental caucus withdrew from the forestry module process before the Forests and Fish Report was completed. In addition, several Tribes in the Tribal caucus withdrew. The

environmental caucus and three Tribes, including the Puyallup, Muckleshoot, and Yakama, then developed their own separate proposals.

In June 1999, the Washington governor signed the "Salmon Recovery Bill" (ESHB 2091) into law. The bill recommends that the Forest Practices Board adopt permanent forest practices rules consistent with the Forests and Fish Report, as modified by the bill, on or before June 30, 2001. As part of this bill, landowners with 80 acres or less of forest land statewide will not have to leave expanded riparian buffers (as described in the Forests and Fish Report) on parcels of 20 acres or smaller. Instead, these landowners must comply with the permanent forest practices rules in effect January 1, 1999, but may also have to leave some trees adjacent to streams, comprising no greater than 15 percent of the timber volume in a managed 50-year-old stand.

The Forests and Fish Report proposal, as modified by the legislation (ESHB 2091) and additional refinements, was identified as the preferred alternative by the Forest Practices Board and is referred to as Alternative 2 in this EIS. The no action alternative was defined as the current permanent rules, and is referred to as Alternative 1 in this EIS. In addition, the Forest Practices Board identified a third alternative (Alternative 3) based on the environmental caucus and the three Tribal proposals. Thus, Alternative 3 in this EIS was developed to expand the range of the alternatives under consideration. It was designed to represent a feasible alternative that meets the proposals and objectives, with a higher degree of environmental protection. It incorporates many of the features of the environmental caucus and Tribal proposals that differ from Alternative 2. Specific aspects of the environmental caucus and tribal proposals were selected for Alternative 3, based on reasonableness (as defined under SEPA) and on their degree of consistency with the Forest Practices Board's goals, including the economic viability goal, identified in Section 1.3.

2.3 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

In addition to the alternative based on the Forests and Fish Report (Alternative 2) and the alternative based on the existing permanent rules (Alternative 1), four other proposals were considered by the Forest Practices Board. These proposals included separate proposals from the Puyallup, Muckleshoot, and Yakama Tribes, as well as a proposal from the environmental caucus. As noted above, Alternative 3 was developed by the Forest Practices Board, based on these four proposals.

Although most elements of the individual proposals identified below were incorporated into Alternative 3, the proposals were not analyzed individually in detail because they were not considered to be "reasonable." Under SEPA, a reasonable alternative is a feasible alternative that meets the proposal's objective at a lower environmental cost (SEPA Handbook 1998). A number of elements in each proposal were not considered to be feasible because it is believed that they would not meet the economic viability goal, identified in Section 1.3.

2.3.1 Washington Environmental Council/Audubon or "Environmental Caucus" Proposal

This alternative proposes a number of key changes to existing forest practices rules with the expressed intent of using a low-risk strategy for meeting the first three forest module goals. The proposal is described in the following document:

> "The Salmon Recovery Proposal: A Low-Risk Strategy for Protecting and Restoring Salmon Habitat In Washington's Forested Watersheds" (December 1998) by the Washington Environmental Council and the National Audubon Society.

The key features of this proposal are as follows:

- **Water Typing**—Streams would be typed as either perennial or intermittent waters. Perennial streams would include both fish-bearing and nonfish-bearing waters as well as shorelines.
- **Riparian Habitat—**Perennial streams would receive buffers of 250 feet and intermittent streams would receive buffers of 105 to 250 feet for Douglas-fir forests and 50 to 250 feet for ponderosa pine forests, depending on site class. Stream buffers would not be managed for commercial timber harvest. Harvest would only be permitted to improve riparian function. Buffers would be measured from the edge of the channel migration zone (CMZ), beaver habitat zones (BHZs), or channel disturbance zone (CDZ). Small landowners would not be exempted from the riparian habitat rules.
- **Unstable slopes**—A geomorphologist would have to identify unstable slopes, and an annual evaluation of failing slopes would be required. No harvest or road building would be allowed within 50 feet of high hazard slopes, and moderate hazard slopes would be defined differently than in both current rules and the Forests and Fish Report. Public safety would be factored into unstable slope analyses.
- **Forest Roads**—Road construction would be discouraged in riparian management zones (RMZs), such that allowed disturbance within RMZs would be decreased to 5 percent, and any new roads in RMZs would be considered Class IV-Special Activities. Orphan road inventories and assessments would be required within 5 years and then incorporated into road maintenance and abandonment plans, which would have to be planned and completed within 10 years.
- **Wetlands**—All forest canopy in forested wetlands within RMZs would be retained. The SEPA threshold for filling of wetlands would be reduced to 0.25 acre. A new typing system would be developed.
- **Watershed analysis**—Watershed analysis would be modified to include mandatory monitoring plans and incorporate assessment modules for cultural and wildlife resources and a restoration module. The water quality module would be upgraded.
- **Adaptive Management—**The adaptive management process would be tied directly to the Forest Practices Board. TFW would have no specific role. A new stakeholder committee would be instituted that would not work on a consensus basis for facilitating public participation, and the state science team would be used for peer review.

- **Forest Pesticides—**No aerial spraying of pesticides would be allowed within RMZs. Unique to this proposal, pesticide-use training of operators and landowners involved in pesticide applications would be required.
- **Cultural Resources—**This proposal would add a cultural resources module to watershed analysis.

2.3.2 Puyallup Tribal Proposal

This alternative is very similar to the Muckleshoot Tribal proposal described below. It also proposes a number of key changes to existing forest practices rules with the overall goal of maintaining, protecting, and restoring the habitat that will sustainably provide the commercially harvestable fish, wildlife, and plant resources upon which the Tribe depends. The proposal is described in the following document:

> "A Tribal Proposal for New Forest Practices Rules to Comply with the Endangered Species Act and the Clean Water Act" (January 1999) by the Puyallup Tribe of Indians.

The key features of this proposal are as follows:

- **Water Typing**—Stream typing would be based on stream geomorphic characteristics (i.e., stream gradient). Streams with gradient between 0 and 20 percent would be considered fish-bearing streams; streams between 20 and 30 percent gradient would be considered coarse sediment storage and large woody debris (LWD) sources; and streams with greater than 30 percent gradient would be considered the CDZ and LWD source.
- **Riparian Habitat—**Fish-bearing streams would receive 200-foot buffers. Streams with a 20 to 30 percent gradient would receive 100-foot buffers and streams with a greater than 30 percent gradient would receive 70-foot buffers. Stream buffers would not be managed for commercial timber harvest. It includes options for harvest to improve riparian condition. Buffers would be measured from the edge of the CMZ, BHZs, or CDZs. Small landowners would not be exempt from the riparian habitat rules.
- **Unstable slopes—**Unstable slopes would be regulated in a manner similar to the Washington Environmental Council /Audubon proposal. Public safety would not be factored into unstable slope analyses.
- **Forest Roads—**Road construction in RMZs would be managed similar to the Washington Environmental Council/Audubon proposal. Orphan road inventories and assessments would be required within 2 years, depending on their potential for impact, and then incorporated into road maintenance and abandonment plans, which would have to be planned and completed within 10 years. Road density would be reduced to 2 mi/mile^2.
- **Wetlands—**The SEPA threshold for filling of wetlands would be reduced to 0.25 acre. A new typing system would be developed. An interim buffer would be established around certain wetlands that would be up to one site potential tree height in width and would be based on Ecology's classification system.

- **Watershed Analysis—**Watershed analysis would be used to adjust rules to site-specific situations. In addition, certain mandatory monitoring efforts would be prescribed as default for landowners operating under current rules. A cultural resources module would be developed.
- **Adaptive Management—**The adaptive management process would be tied directly to the Forest Practices Board. TFW would have no specific role. A fully funded state-wide monitoring plan would be implemented.
- **Forest Pesticides—**No aerial spraying of pesticides would be allowed within the RMZs.
- **Cultural Resources—**Unique to this proposal, a new process would be defined for protecting Tribal cultural resources in riparian areas using Tribally acceptable assessment and mitigation approaches. A cultural resources module would be added to watershed analysis.

2.3.3 Muckleshoot Tribal Proposal

This alternative also proposes a number of key changes to existing forest practices rules with the overall goal of maintaining, protecting, and restoring habitat that can provide a sustainable commercially harvestable fishery resource and sustainable wildlife and plant resources on which the Tribes depend. It is very similar to the Puyallup Tribal proposal. The Muckleshoot Tribal proposal is described in the following document:

> "A Tribal Proposal for New Forest Practices Rules to Protect Public Resources, Produce Harvestable Number of Salmon in accordance with the State of Washington Salmon Recovery Plan and to comply with the Endangered Species Act" (January 1999) by the Muckleshoot Indian Tribe Fisheries Department.

The key features of this proposal are as follows:

- **Water Typing**—Stream typing would be similar to that proposed in the Puyallup proposal described above.
- **Riparian Habitat**—Riparian habitat protection would be similar to that proposed in the Puyallup proposal described above.
- **Unstable slopes—**Unstable slopes would be regulated in a manner similar to the Puyallup proposal.
- **Forest Roads—**Forest roads would be managed in a manner similar to the Puyallup proposal.
- **Wetlands—**Wetlands would be managed in a manner similar to the Puyallup proposal.
- **Watershed analysis—**Watershed analysis would be similar to that described in the Puyallup proposal, except that a new cultural resources module would not be required.
- **Adaptive Management—**Adaptive management would be similar to that described in the Puyallup proposal.
- **Forest Pesticides—**No aerial spraying of pesticides would be allowed within the RMZs.

- **Cultural Resources**—No specific cultural resources recommendations were presented.

2.3.4 Yakama Nation Proposal

This alternative also proposes a number of key changes to existing forest practices rules with the overall objective of providing sufficient habitat and water quality conditions to support harvestable populations of fish, riparian-dependent wildlife, and plant communities important to the Tribes, the federal government, and the state of Washington. The proposal is described in the following document:

> "A Tribal Strategy for New Forest Practice Regulations to Provide Sufficient Habitat and Water Quality Conditions Necessary for Healthy and Harvestable Populations of Aquatic Biota and Riparian-dependent Wildlife (February 1999) by the Yakama Indian Nation.

The key features of this proposal are as follows:

- **Water Typing**—Streams would be typed using a system that is similar to the system proposed in the Forests and Fish Report.
- **Riparian Habitat**—Rivers and large streams would receive 330-foot buffers, and medium and small fish-bearing streams would receive 165-foot buffers. Perennial streams would receive 100-foot buffers, and intermittent streams would receive 70-foot buffers. Stream buffers would not be managed for commercial timber harvest. Cutting in riparian buffers would be prohibited except for removal of up to 20 percent of the merchantable volume of timber in a 50-year period. Buffers would be measured from the edge of the CMZ, BHZs, or CDZ. Small landowners would not be exempt from the riparian habitat rules.
- **Unstable slopes**—Unstable slopes would be regulated in a manner similar to that described for the Puyallup proposal.
- **Forest Roads**—Forest roads would be managed in a manner that would be similar that described for the Puyallup proposal.
- **Wetlands**—Wetlands would be managed in a manner similar to that described for the Puyallup proposal. An exception would be that buffer widths would be wider, ranging from 70 to 200 or more feet, depending on wetland category.
- **Watershed analysis**—Watershed analysis would be conducted in a manner similar to the Puyallup proposal. However, both wildlife and cultural resources modules would be added to the watershed analysis process.
- **Adaptive Management**—Adaptive management would be similar to that described in the Puyallup proposal.
- **Forest Pesticides**—No aerial spraying of pesticides would be allowed within the RMZs.
- **Cultural Resources**—This proposal would add a cultural resources module to watershed analysis.

2.4 ALTERNATIVES CONSIDERED IN DETAIL

The Washington Forest Practices Rules (WAC 222) are adopted by the Forest Practices Board under the authority of the Washington Forest Practices Act (RCW 76.09) and are administered and enforced by DNR. These rules apply to all non-federal forest lands (primarily state and private), with the exception of certain HCPs and certain urban growth areas, primarily in western Washington. State-managed forest lands in western Washington are not governed by most of these rules because of the DNR HCP, which applies to anadromous fish and wildlife on the westside (Appendix A).

The rules have been categorized into a number of topics. The three alternatives considered in detail in this EIS include different assemblages of rule concepts associated with nine specific topics. The alternatives are described below with reference to each of the topics. In addition, Table S-1 presents a summary comparison of how each rule topic is addressed in each alternative.

2.4.1 Alternative 1

Alternative 1 represents the No Action Alternative. It entails continuing with the existing permanent forest practices rules and does not include the revisions to these rules produced by the water typing, salmonid, or forests and fish emergency rules. SEPA requires that the No Action Alternative in an EIS should be based on only permanent rules, not temporary rules. The No Action Alternative is defined in the Washington Forest Practices Rule Book, dated November 1998. A summary of these rules is provided below.

2.4.1.1 Water Typing

Under Alternative 1, water typing rules would be the same as existing rules (WAC 222-16-030). Five water types are recognized as follows:

- Type 1—Major waterways of the state including rivers, lakes, and saltwater. They include all waters inventoried as “shorelines of the state” (RCW 90.58).
- Type 2—Waters, not classified as Type 1, which have high fish, wildlife, or human use. They generally are streams wider than 20 feet. (measured between the ordinary high water marks) with a gradient of less than 4 percent.
- Type 3—Waters, not classified as Types 1 or 2, which have moderate to slight fish, wildlife, or human use. They generally are less than 20 feet and greater than 5 feet wide, with a gradient of less than 12 percent.
- Type 4—Waters not classified as Types 1, 2, or 3, which are important for protecting downstream water quality. They generally are streams wider than 2 feet and less than 5 feet.
- Type 5—Waters not classified as Types 1, 2, 3, or 4. They are generally seasonal headwater streams, less than 2 feet wide.

2.4.1.2 Riparian Habitat

Under Alternative 1, RMZs are identified along Type 1, 2, and 3 streams (WAC 222-30). These zones are measured horizontally from the ordinary high-water mark. They are different in western Washington and in eastern Washington. Harvest is limited within

RMZs; leave trees for wildlife and fisheries habitat are left unharvested as prescribed below.

The number, size, species, and ratio of leave trees (conifer to deciduous), is determined by the water type, stream width, and the bed material. Leave trees are generally to be evenly distributed with some clumping. The presence of stream-adjacent parallel roads in the RMZs does not affect RMZ widths or leave-tree requirements.

In addition to the RMZ requirements identified in this section, Type 1 waters are given additional protection under the Shoreline Management Act. Restrictions under the Act include a 200-foot shoreline management zone (SMZ), measured from the ordinary high water mark, that is implemented and enforced at the county level. Within the SMZ, a landowner may remove no more than 30 percent of the available merchantable trees every 10 years using a selective harvest strategy.

Western Washington RMZs

In western Washington, the outer edge of an RMZ is defined as the line where vegetation changes from wetland to upland plant community, or the line required to leave sufficient shade (see section below), whichever is greater, but no less than 25 feet wide, nor more than the maximum widths defined in Table 2-1. RMZ widths are to be expanded as necessary to include wetlands or ponds adjacent to the stream. In addition to the leave-tree requirements in Table 2-2, an average of five of the largest trees per acre (at the ratio of one coniferous to one deciduous tree) is to be left within the zone for wildlife habitat.

Table 2-1. Western Washington RMZ Widths and Leave Tree Requirements (Alternative 1)

Water Type and Average Width	RMZ Minimum and Maximum Widths	Ratio of Conifer to Deciduous Trees and Minimize Size of Leave Trees	# Trees / 1,000 Feet Each Side	
			Gravel or Cobble <10" Diameter	Boulder or Bedrock
Type 1 and 2 water 75 feet and over	25 to 100 feet	Representative of stand	50 trees	25 trees
Type 1 and 2 water 75 feet and over	25 to 75 feet	Representative of stand	100 trees	50 trees
Type 3 water 5 feet and over	25 to 50 feet	2 to 1 ratio 12 inches or next largest available	75 trees	25 trees
Type 3 water less than 5 feet	25 feet	1 to 1 ratio 6 inches or next largest available	25 trees	25 trees

RMZs are not required along Type 4 and 5 waters. However, riparian leave-tree areas are sometimes required along Type 4 waters where such practice is necessary to protect public resources. In these cases, 25 conifer or deciduous trees, at least 6 inches in diameter at breast height (dbh), are to be left within 25 feet of each side of the stream per 1,000 feet of stream length.

Eastern Washington RMZs

In eastern Washington, the outer edge of an RMZ is defined as the line where vegetation changes from wetland to upland plant community, or the line required to leave sufficient shade (as defined in the section below), whichever is greater, but no less than 30 feet wide,

nor more than the maximum widths defined in Table 2-2. RMZ widths are to be expanded as necessary to include wetlands or ponds adjacent to the stream.

RMZs are not required along Type 4 and 5 waters. However, under special circumstances, riparian leave-tree areas are required, as described for western Washington RMZs.

Table 2-2. Eastern Washington RMZ Widths and Leave Tree Requirements (Alternative 1)

Harvest Type	RMZ Minimum and Maximum Widths	# Trees/Acre 4" dbh or Larger		Additional Requirements
		Gravel or Cobble <10" Diameter	Boulder or Bedrock	
Partial Cutting	30 to 50 feet	135 trees	75 trees	16 conifers 12 to 20 inches dbh/acre 3 conifers >20 inches dbh/acre 3 deciduous trees 12 to 16 inches dbh/acre 2 deciduous trees >16 inches dbh/acre
Even-Aged	30 to 300 feet			

Sufficient Shade

Sufficient shade is defined by graphs found in Section 1 of the Forest Practices Board Manual (Washington Forest Practices Board, 1998). The graphs define a minimum percent canopy cover that must be maintained if harvest is to take place within the RMZ. The minimum is based on elevation and the water quality temperature classification (16 or 18 degrees C) of the stream.

Retention of Wildlife Leave Trees and Down Logs

In addition to the leave-tree requirements associated with RMZs and shade defined above, the current rules require a minimum of two to three wildlife reserve trees per acre, two green recruitment trees per acre, and two down logs per acre to be left throughout each harvest unit.

Salvage Logging within RMZs

No specific restrictions on salvage logging in RMZs are included under Alternative 1.

Cable Yarding

No timber is to be cable-yarded in or across Type 1, 2, or 3 waters, except where the logs will not materially damage the bed of waters, banks, or RMZs, and the removal has a hydraulic project approval from WDFW.

2.4.1.3 Unstable Slopes

Under Alternative 1, unstable slopes are reviewed as part of the forest practices application. Unstable areas are defined as slide prone areas. Slide prone areas are determined by DNR and are generally defined as excessively steep or unstable soils. DNR determines whether slopes are unstable using available soils information, from evidence of geologically recent slumps or slides, where the natural slope exceeds the angle of repose for the particular soil types present, or where springs or seeps may indicate unstable conditions are present. If the unstable slope has the potential to deliver sediment to a

public water body, the application would be processed as a Class IV-Special and becomes subject to SEPA rules (WAC 222-16-050 (1)*(d)and*(e)) (see Section 1.4.1).

2.4.1.4 Forest Roads

Under Alternative 1, road maintenance and road construction standards would remain the same as the current forest practices rules (chapter 222-24 WAC). Road maintenance and abandonment plans would only be required based on watershed analysis prescriptions or DNR request.

2.4.1.5 Wetlands

Under Alternative 1 (WAC 222-3-020*(6)and*(7)), two categories of wetlands are defined: forested and nonforested. Non-forested wetlands are then subdivided into two types: Type A and Type B. Type A wetlands are those with open water and include nonforested wetlands that are greater than 0.5 acre in size and bogs or fens (which may be forested) greater than 0.25 acre in size. Type B wetlands are mostly vegetated, nonforested wetlands greater than 0.5 acre in size. Both types of wetlands require the establishment of variable-width wetland management zones (WMZs) ranging from 25 to 200 feet. In contrast, forested wetlands receive less protection than nonforested wetlands. WMZs are not established on forested wetlands; however, harvest methods are limited to low-impact harvest or cable systems. Road and landing construction within either forest or nonforested wetlands require the use of a mitigation sequence.

2.4.1.6 Watershed Analysis

In general, watershed analysis is a process whereby watershed-specific resource sensitivities are identified, based on the results of a number of resource assessments. Once these sensitivities are defined, management prescriptions are developed to address them in a prioritized manner in the watershed. Monitoring may or may not be incorporated into the process.

Under Alternative 1 (chapter 222-22 WAC), watershed analysis is voluntary for private landowners, but is required to be conducted by DNR on all watersheds of the state, as funding allows. The watershed analysis process is based on the Washington Forest Practices Board Manual: Standard Methodology for Conducting Watershed Analysis. This manual was created by a consortium of individuals associated with the TFW process and supervised by TFW's Cooperative Monitoring Evaluation and Research Committee (CMER). Nine resource assessments (modules) are defined under the current process including the following: mass wasting, surface erosion, hydrology, riparian, stream channel, fish habitat, water quality, water supply/public works, and routing. No modules addressing cultural resources, restoration, or wildlife are currently included in the state watershed analysis process, and monitoring is optional.

2.4.1.7 Adaptive Management

Under Alternative 1 (WAC 222-08-035(2) and 222-12-045), adaptive management is a process for changing forest practices rules in response to cooperative research, monitoring, and evaluation. DNR is required to report opportunities to modify forest practices rules to the Forest Practices Board when baseline data, monitoring, evaluation, or the use of

interdisciplinary teams indicate that changes will better meet the purposes and policies of the Forest Practices Act. TFW CMER projects have provided input used to make improvements in the past. However, there are no specific timelines or procedures for ensuring that necessary changes are made to the rules.

2.4.1.8 Forest Pesticides

Pesticide rules (chapter 222-38 WAC) under Alternative 1 regulate primarily the handling, storage, and application of pesticides to prevent impacts to public health, lands, fish, wildlife, aquatic habitat, and water quality. These rules are consistent with Washington State Department of Agriculture regulations. Several other laws and regulations apply to the conduct of forest practices (chapter 222-50 WAC), some of which are administered by other agencies and may require permits from such agencies prior to the conduct of certain forest practices.

Under current rules, pesticides cannot be applied within 200 feet of residences or within 100 feet of other properties (e.g., farmland). In addition, pesticides cannot be ground-applied with power equipment within 25 feet of all nonforested wetlands, as well as all other typed waters, excluding Type 4 and 5 waters with no surface water. Pesticides cannot be aerially applied within a 50-foot buffer established on all typed waters, excluding Type 4 and 5 waters with no surface water and other areas of open water, such as ponds or sloughs. Pesticides may be used in either RMZs or WMZs; however, they must be applied by hand. Direct entry of pesticides into any typed waters, except segments of Type 4 and 5 waters with no surface water, is prohibited.

2.4.1.9 Cultural Resources

Under Alternative 1, cultural resources are protected relative to forest practices in three ways. First, forest practices involving lands containing archaeological or historic sites registered with the Washington State Office of Archaeology and Historic Preservation, or on sites containing evidence of North American cairns, graves, or glyptic records, are categorized as Class IV-Special Practices (WAC 222-16-050(i)(g)). These practices require an environmental checklist in compliance with SEPA, as they have the potential for a substantial impact on the environment. Additional information including a detailed environmental statement may also be required. A Class IV-Special Application must be filed with DNR. DNR consults with affected Indian Tribes in identifying cultural sites.

Second, forest practices involving lands containing cultural, historic, or archaeological resources which, at the time the application or notification is filed are a) listed or are eligible for listing with the National Register of Historic Places, or b) have been identified to DNR as being of interest to an affected Indian Tribe, are categorized as Class III practices (WAC 222-16-050(5)(k)). These practices require a Class III application which has to be approved by DNR. For Class III applications, the landowner must meet with the appropriate Indian Tribe to determine which cultural resources are present and discuss their protection.

Third, cultural resources are protected incidentally because of the protections provided for riparian habitat and wetlands (described above under Riparian Habitat).

2.4.1.10 Hydrology

Current forest practices rules can condition the size of a clearcut in the significant rain-on-snow zone of a watershed where peak flows have resulted in material damages to public resources (WAC 222-22-100*(2)).

2.4.2 Alternative 2

Alternative 2 represents the alternative defined by the Forests and Fish Report (April 29, 1999), as supplemented by ESHB 2091 and as subsequently refined. The groups contributing to the development of this report included state agencies (DNR, WDFW, and Ecology), federal agencies (USFWS, NMFS, and EPA), the Colville Confederated Tribes, the Northwest Indian Fisheries Commission, the Washington State Association of Counties, the Washington Forest Protection Association, and the Washington Farm Forestry Association.

Under the Forest and Fish Report and ESHB 2091, the Governor's office is granted the authority to negotiate an HCP with USFWS and NMFS. Under the Forest and Fish Report, this plan would be targeted for a 50-year period. However, this should not be construed to mean that Alternative 2 would actually be implemented for a 50-year period. The 50-year time period is not a requirement of ESHB 2091, and the actual time span for an HCP would be an issue for negotiation between Washington State and USFWS and NMFS. Nevertheless, a 50-year time span is the principal period considered for Alternative 2 and the EIS in general.

2.4.2.1 Water Typing

Under Alternative 2, the following three water types are recognized:

- Type S: All waters inventoried as "shorelines of the state."
- Type F: Waters not classified as Type S, which contain fish habitat. It also includes some waters diverted for domestic and fish hatchery use.
- Type N: Waters not classified as Type S or F, which are either perennial streams or are physically connected by an above-ground channel system to downstream waters such that water or sediment initially delivered to such waters will eventually be delivered to a Type S or F water. Type N waters include two subcategories: seasonal and perennial streams.

Streams of the state would be classified according to this system by DNR in cooperation with WDFW and Ecology, and in consultation with affected Indian Tribes. The mapping would be based on a multiparameter, field-verified GIS logistic regression model. This model would be habitat-driven and use geomorphic parameters. Until these water type maps are available, an interim typing system would be used. Fish habitat water types would be updated every 5 years based on observed field conditions.

2.4.2.2 Riparian Habitat

Under Alternative 2, RMZs are identified along all streams. These zones are measured horizontally from the bankfull width or CMZ, whichever is greater. The CMZ is defined as the area where the active channel is prone to move and where such movement would

result in a potential near-term loss of riparian forest adjacent to the stream. RMZs differ according to which side of the state they occur on, as defined in Figures 2-1 and 2-2. RMZ dimensions also vary depending on the stream type, the site class of the land adjacent to the typed water, the management harvest option, and the stream size.

This section provides a general description of the riparian measures incorporated into Alternative 2. A detailed description of the riparian habitat components of Alternative 2 and the emergency rules that are currently in effect are provided in the Forests and Fish Report (April 1999).

In addition to the RMZ requirements identified in this section, Type S waters are given additional protection under the Shoreline Management Act. This additional protection would be the same as that described under Alternative 1 (Section 2.4.1.2).

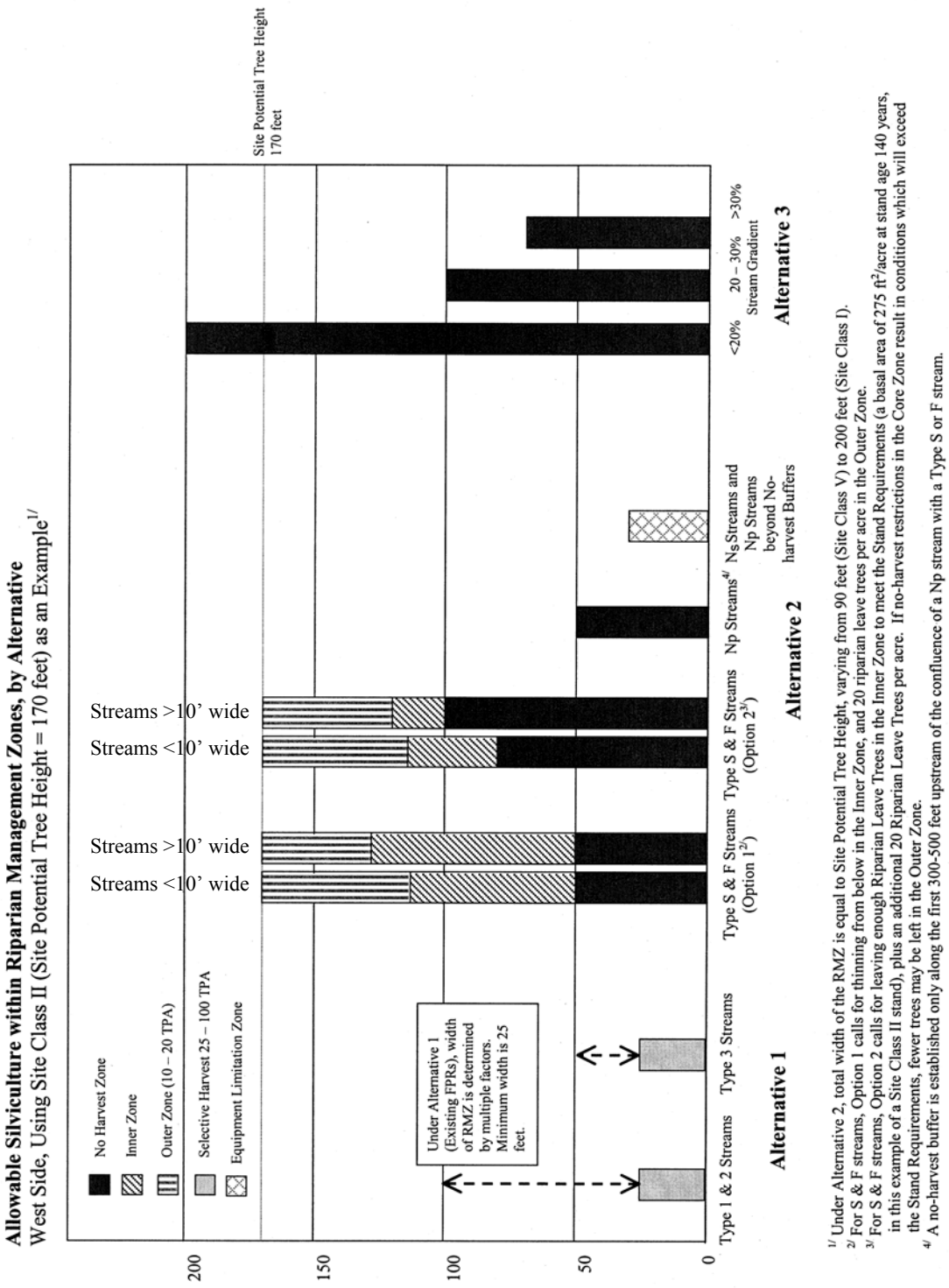
Western Washington—Type S and F Waters

In western Washington, RMZs for Type S and F waters are divided into three zones: the core zone is closest to the water or CMZ, the inner zone is the middle zone, and the outer zone is farthest from the water.

Core Zone

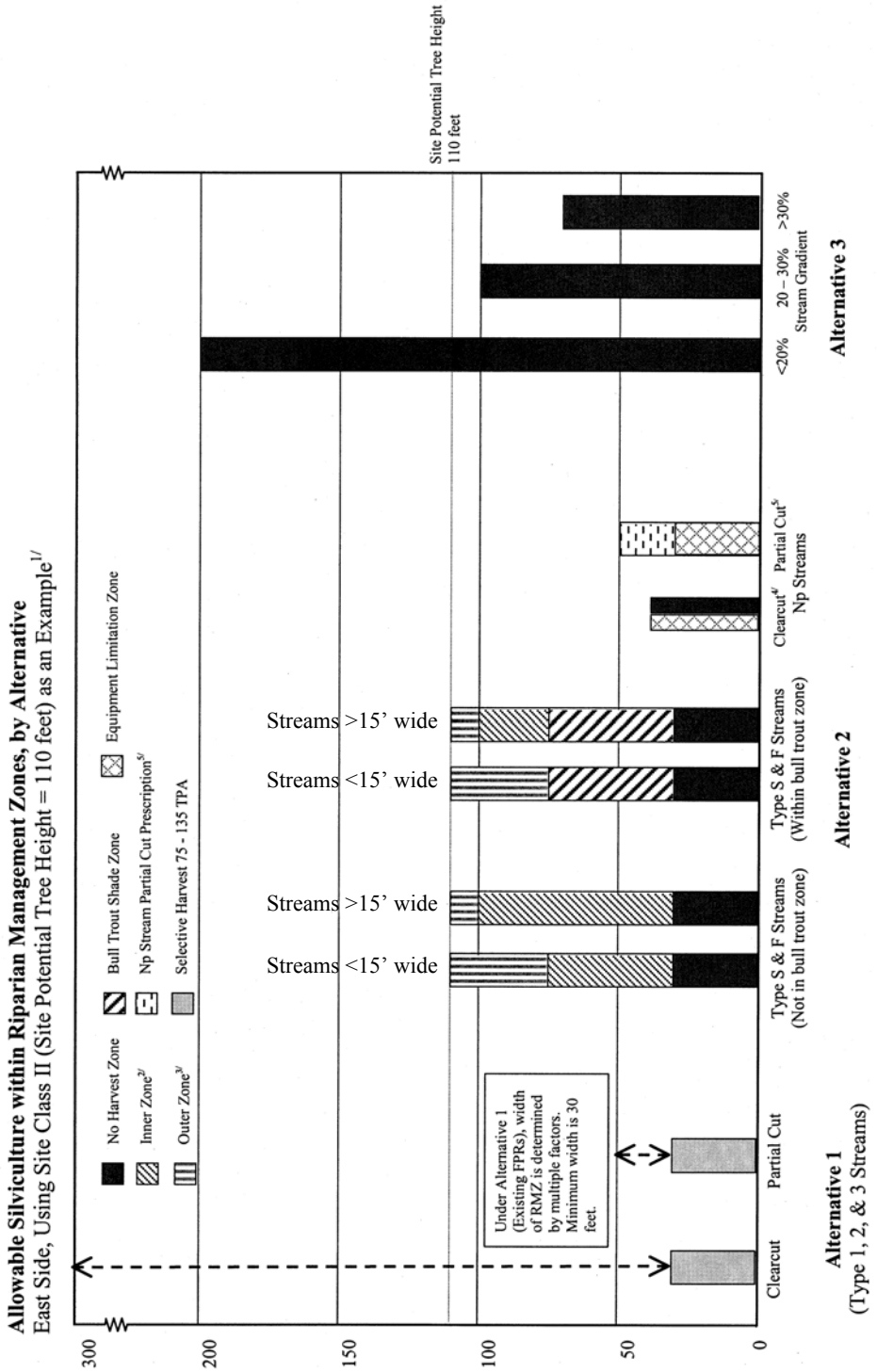
The core zone in western Washington is 50 feet in width. With the exception of road crossings and yarding corridors, no timber harvest or construction is allowed in the core zone. Any trees cut for or damaged by yarding corridors must be left on site.

Figure 2-1. RMZ Width and Degree of Protection Provided for the West Side By Alternative



1/ Under Alternative 2, total width of the RMZ is equal to Site Potential Tree Height, varying from 90 feet (Site Class V) to 200 feet (Site Class I).
2/ For S & F streams, Option 1 calls for thinning from below in the Inner Zone, and 20 riparian leave trees per acre in the Outer Zone.
3/ For S & F streams, Option 2 calls for leaving enough Riparian Leave Trees in the Inner Zone to meet the Stand Requirements (a basal area of 275 ft^2/acre at stand age 140 years, in this example of a Site Class II stand), plus an additional 20 Riparian Leave Trees per acre. If no-harvest restrictions in the Core Zone result in conditions which will exceed the Stand Requirements, fewer trees may be left in the Outer Zone.
4/ A no-harvest buffer is established only along the first 300-500 feet upstream of the confluence of a Np stream with a Type S or F stream.

Figure 2-2. RMZ Width and Degree of Protection Provided for the East Side by Alternative



1/ Under Alternative 2, total width of the RMZ is equal to Site Potential Tree Height, varying from 75 feet (Site Class V) to 130 feet (Site Class I). Note that the minimum RMZ width for streams greater than 15 feet wide is 100 feet.
2/ For Alternative 2 S & F streams, the Inner Zone prescription requires leaving at least 50 trees per acre after harvest, of which 21 are the largest trees, and 29 are at least 10 inches dbh. If the resulting basal area is less than 90 ft^2/acre, then enough additional 10-inch-or-greater trees must be left to meet this target.
3/ For Alternative 2 S & F streams, the Outer Zone prescription requires leaving 50 trees per acre, of which 15 are at least 20 inches dbh
4/ Clearcut strategy may be implemented in no more than 30% of the stream reach in a harvest unit, and only if an equal area is designated as a no-cut zone.
5/ For Alternative 2 Np streams in partial cut areas, leave the 10 largest trees per acre, plus as many additional trees >6" dbh as will result in a basal area of at least 90 ft^2/acre.

INNER ZONE

The inner zone varies from 10 to 100 feet in width, depending on stream size, site class, and the management option (described below). Timber harvest in the inner zone is permitted only when riparian habitat can be maintained or improved; therefore, only limited harvest is allowed if the existing stand exceeds the stand requirement. The stand requirement is the number of trees per acre, basal area per acre, and the proportion of conifer, in the combined inner zone and adjacent core zone, that will provide target riparian stand conditions when the stand is 140 years old. This future stand is referred to as the desired future condition (DFC) and varies with the site class. Growth modeling is necessary to calculate whether a particular stand meets the stand requirement and is on a trajectory towards the DFC. The appropriate growth model is to be based on stand characteristics and on specific components identified in the Forest Practices Board Manual.

When the existing stands in the combined core and inner zone do not meet stand requirements, no harvest is permitted in the inner zone, except for the purpose of hardwood conversion (see below). Two management options are available when basal area exceeds the stand requirement. Widths of inner and outer zones differ between Option 1 and Option 2.

Option 1 for Inner Zones—Thinning from Below. If trees can be harvested and removed from the inner zone because of surplus basal area consistent with the stand requirement, then Option 1, referred to as "thinning from below," can be implemented. The objective of thinning is to distribute leave trees in such a way as to shorten the time required to meet large wood fish habitat and water quality needs. This is achieved by increasing the potential for leave trees to grow larger than they otherwise would without thinning. Trees harvested under Option 1 must comply with the following:

a) Residual trees left in the combined core and inner zones must meet stand requirements necessary to be on a trajectory to desired future condition.
b) Thinning must be from below, meaning the smallest diameter (in dbh) trees will be selected for harvest first, then progressing to successively larger diameters.
c) Thinning cannot decrease the proportion of conifer in the stand.
d) Shade retention to meet the shade rule must be confirmed by the landowner for any harvest inside of 75 feet from the bankfull width or CMZ, whichever is greater.
e) The number of residual trees per acre in the inner zone will equal or exceed 57.

Two other factors affect the amount of harvest under Option 1: the presence of stream-adjacent parallel roads within the inner or core zone and the use of use of yarding corridors across the RMZ. In both cases, the shortfall of basal area due to these factors has to be accounted for by reducing harvest. Implementation of an acceptable LWD placement plan can be used to make up for shortfalls due to roads.

Table 2-3 identifies the width of each zone within an RMZ in which Option 1 is implemented, given the stream width and site class of adjacent land.

Table 2-3. Option 1, Thinning from Below

Site Class	RMZ Width	Core Zone Width (measured from Bankfull width or CMZ of water)	Inner Zone Width (measured from outer edge of core zone)		Outer Zone Width (measured from outer edge of inner zone)	
			Stream Width ≤10'	Stream Width >10'	Stream Width ≤10'	Stream Width>10'
I	200'	50'	83'	100'	67'	50'
II	170'	50'	63'	78'	57'	42'
III	140'	50'	43'	55'	47'	35'
IV	110'	50'	23'	33'	37'	27'
V	90'	50'	10'	18'	30'	22'

Option 2 for Inner Zones—Leaving Trees Closest to the Water. If trees can be harvested and removed from the inner zone because of surplus basal area consistent with the stand requirement, then Option 2 can be implemented. Option 2 applies only to RMZs on site classes I, II, and III on streams that are less than or equal to 10 feet wide and to RMZs on site classes I and II for streams greater than 10 feet wide. Harvest must comply with the following:

a) Harvest is not permitted within 30 feet of the core zone for streams less than or equal to 10 feet wide, and harvest is not permitted within 50 feet of the core zone for streams greater than 10 feet wide.

b) Residual leave trees in the combined core and inner zone must meet the stand requirements needed to be on a trajectory to the desired future condition.

c) A minimum of 20 riparian leave trees per acre will be retained in any portion of the inner zone where harvest occurs. These riparian leave trees are not to be counted or considered towards meeting applicable stand requirements, nor can the number be reduced below 20 for any reason.

d) Trees are selected for harvest starting from the outermost portion of the inner zone first, then progressively closer to the stream.

e) If the existing stand conditions in the core and inner zones result in surplus basal area per the stand requirement, the landowner may take credit for the surplus by harvesting additional riparian leave trees required to be left in the adjacent outer zone on a basal-area-for-basal area basis. The number of leave trees in the outer zone cannot be reduced below 10 trees per acre (except for CMZ credit).

As is the case for Option 1, the presence of stream-adjacent parallel roads within the inner or core zone and the use of use of yarding corridors across the RMZ also affect the amount that can be harvested under Option 2. In both cases, the shortfall of basal area due to these factors has to be accounted for by reducing harvest. Implementation of an acceptable LWD placement plan can be used to make up for shortfalls due to roads.

Table 2-4 identifies the width of each zone within an RMZ in which Option 2 is implemented, given the stream width and site class of adjacent land.

Hardwood Conversion for Inner Zones. Landowners have the option of conducting hardwood conversion in the inner zone of the RMZ on the west side only. The riparian areas must be hardwood-dominated stands with evidence that conifers were dominant in the past. The objective of the hardwood conversion rule is to improve long-term riparian function by allowing landowners to remove hardwoods in the conversion area and restock the area with conifers. There are numerous restrictions to implementing hardwood conversion. These include the following:

a) The combined core and inner zone do not meet stand requirements.

b) There are fewer than 57 conifer trees 8 inches or larger dbh per acre.

c) There are fewer than 100 conifer trees 4 inches or larger dbh per acre.

d) Conifer trees greater than 20 inches dbh shall not be harvested in the conversion area.

e) No more than 10 percent of the conifer trees greater than 8 inches dbh may be harvested.

f) The conversion area must be restocked with conifers and provided with post-harvest treatment.

g) Conversion areas are limited to 500 feet in length.

h) Landowners must own the land 500 feet above and below the conversion area.

i) No stream parallel roads are present in the core or inner zone.

j) Restrictions for the protection of shade apply (See WAC 222-30-021 for details).

The rule includes a component for tracking conversion rates on a watershed basis. The adaptive management program is charged with identifying adverse-effect thresholds for conversion levels on a watershed basis.

OUTER ZONES

Timber harvest in the outer zone must leave 20 riparian leave trees per acre after harvest. Riparian leave trees are trees that must be left after harvest in the outer zone in western Washington and are identified in Table 2-5. These trees must be left uncut throughout all future harvests.

Table 2-4. Option 2, Leaving Trees Closest to Water

Site Class	RMZ Width	Core Zone Width[1/]	Inner Zone Width[2/]		Outer Zone Width[3/]	
			Stream Width <10'[4/]	Stream Width >10' [5/]	Stream Width <10'[1/]	Stream Width >10'
I	200'	50'	84'[4/]	84'[5/]	50'	66'
II	170'	50'	64'[4/]	70'[5/]	50'	50'
III	140'	50'	44'[4/]	[6/]	[2/]	[6/]

1/ Measured from bankfull width or CMZ, whichever is greater.
2/ Measured from outer edge of Core Zone.
3/ Measured from outer edge of Inner Zone.
4/ Under Option 2, harvest is not permitted within 30 feet of the core zone for streams less than or equal to 10 feet wide.
5/ Under Option 2, harvest is not permitted within 50 feet of the core zone for streams greater than 10 feet wide.
6/ Option 2 is not permitted for Site Class III on streams greater than 10 feet wide.

Table 2-5. Outer Zone Riparian Leave Tree Requirements for Western Washington

Application	Leave Tree Spacing	Tree Species	Minimum dbh Required
Outer zone	Dispersed	Conifer	12-inch dbh or greater
Outer zone	Clumped	Conifer	12-inch dbh or greater
Protection of sensitive features	Clumped	Trees representative of the overstory including both hardwood and conifer	8-inch dbh or greater

The riparian leave trees must be left on the landscape according to one of the following two strategies. The third strategy is available to landowners who agree to an LWD placement plan.

a) Dispersal strategy. Riparian leave trees, which means conifer species with a dbh of 12 inches or greater, must be left dispersed approximately evenly throughout the outer zone.

b) Clumping strategy. Riparian leave trees must be left clumped in the following way: clump trees, with a dbh of 8 inches or greater, in or around sensitive features (primarily seeps and springs, forested wetlands, areas that would provide windthrow protection, small unstable slopes, or archaeologic or historic sites) to the extent these are present in the outer zone. If sensitive features are not present, then clumps must be well distributed throughout the outer zone, and the leave trees must be at least 12 inches dbh in size.

c) LWD in-channel placement strategy. A landowner may design an LWD placement plan in cooperation with WDFW. The landowner may reduce the number of trees that have to be left in the outer zone to the extent provided in the approved LWD placement plan, but not below a minimum of 10 trees per acre (except for CMZ credit).

The 20 riparian leave trees can be reduced in number in two situations: 1) if a landowner agrees to implement a placement strategy as described in the preceding paragraph, or 2) if trees are left in an associated CMZ. In the latter case, the landowner may reduce the number of trees that have to be left according to specified rules (see Emergency Rules, March 20, 2000, WAC 222-30-021*(1)(c)).

Western Washington—Type N Waters

In western Washington, RMZs for Type N waters are defined in two ways. First, an equipment limitation zone (ELZ) is defined for all Type N waters. Second, a 50-foot-wide buffer is required for at least 50 percent of Type N perennial streams. These are described below.

Equipment Limitation Zones—Type N Waters

The area between the bankfull width edge of a Type N water and a line 30 feet from such an edge will be established as an ELZ. Landowners must mitigate for the disturbance of more than 10 percent of the soil within any ELZ as a result of the use of ground-based equipment, skid trails, stream crossings (other then road crossings) or partially suspended cabled logs. A number of other rules designed to reduce soil disturbance, apply to cable yarding, skid trail location and construction, and other logging activities.

No-Harvest Buffers—Type N Perennial Waters

For Type N perennial streams, a 50-foot, no-harvest buffer will be established along each side of the stream for at least 50 percent of the stream length. The locations for these buffers will include a 500-foot length upstream from the junction of the Type N stream with a Type S or F stream and a specified area associated with sensitive sites (including soil zones perennially saturated from a headwall seep, a side-slope seep, a headwater spring of perennial flow for a Type N perennial water, an alluvial fan, or the point of intersection of two or more Type N perennial streams). If these sensitive sites do not add up to 50 percent of the stream, then the landowner must add buffers in specified priority areas. Additional acres equal to the number of acres occupied by an existing stream-adjacent parallel road within a specified sensitive site buffer or priority area must also be added. Landowners are also required to, the extent reasonably practical, avoid creating yarding corridors and road crossings through sensitive sites and avoid soil compaction and vegetation removal in perennially moist areas.

Eastern Washington—Type S and F Waters

In eastern Washington, RMZs for Type S and F waters are also divided into three zones: the core zone is closest to the water or CMZ, the inner zone is the middle zone, and the outer zone is farthest from the water.

Core Zone

The core zone in eastern Washington is 30 feet wide. With the exception of road crossings and yarding corridors, no timber harvest or construction is allowed in the core zone. Any trees cut for or damaged by yarding corridors must be left on site.

INNER ZONE

The inner zone varies from 45 to 70 feet wide, depending on stream size. The degree of timber harvest permitted in the inner zone varies by habitat type. Three habitat types are defined for eastern Washington based on elevation: Ponderosa pine (0 to 2,500 feet), mixed conifer (2,501 to 5,000 feet), and high elevation (greater than 5,000 feet) habitat types. Tables 2-6 and 2-7 present RMZ widths for eastern Washington areas, relative to stream size and the site class of adjacent lands.

Ponderosa Pine Habitat Type. RMZ widths are as defined in Tables 2-6 and 2-7. No harvest within the inner zone is permitted unless the basal area of conifer and hardwoods is greater than 110 square feet per acre for trees greater than 6 inches dbh, or unless the basal area of conifer and hardwoods is less than 60 square feet per acre for trees greater than 6 inches dbh (Table 2-8).

Two other factors that must be considered relate to down wood and stream-adjacent parallel roads. At least 12 tons of down wood per acre must be left behind, with restrictions on size. Also, when a stream-adjacent parallel road is present in the inner zone, and the minimum required basal area cannot be met due to the presence of the road, then inner zone harvest is restricted based on the stream size and the proximity of the road to the stream.

Mixed Conifer Habitat Type. RMZ widths are as defined in Tables 2-6 and 2-7 below. No harvest is permitted within the inner zone unless the basal area of conifer and hardwoods for trees greater than 6 inches dbh is as follows:

- Greater than 110 or less than 70 square feet per acre on low site indexes (site index less than 90)
- Greater than 130 or less than 90 square feet per acre on medium site indexes (site index between 90 and 110)
- Greater than 150 or less than 110 square feet per acre on high site indexes (site index greater than 110)

If the basal area meets the maximum requirements above, then harvest is permitted. Harvest must leave at least 50 trees per acre with at least a basal area of 70 square feet per acre on low site indexes, or 90 square feet per acre on medium site indexes, or 110 square feet per acre on high site indexes as shown in Table 2-9. If basal area is below the minimum and there are more than 120 trees per acre, the stand can be thinned down to 120 trees per acre.

Table 2-6. Eastern Washington RMZ Widths for Streams Less than or Equal to 15 Feet Wide

Site Class	Total RMZ Width	Core Zone Width[1/]	Inner Zone Width	Outer Zone Width
I	130'	30'	45'	55'
II	110'	30'	45'	35'
III	90'	30'	45'	15'
IV	75'	30'	45'	0
V	75'	30'	45'	0

1/ Measured from bankfull width or CMZ, whichever is greater.

Table 2-7. Eastern Washington RMZ Widths for Streams Greater than 15 Feet Wide

Site Class	Total RMZ Width	Core Zone Width[1/]	Inner Zone Width	Outer Zone Width
I	130'	30'	70'	30'
II	110'	30'	70'	10'
III	100'	30'	70'	0
IV	100'	30'	70'	0
V	100'	30'	70'	0

1/ Measured from bankfull width or CMZ, whichever is greater.

Table 2-8. Inner Zone Harvest Prescriptions for the Ponderosa Pine Habitat Type

Inner Zone Basal Area and Trees per Acre (trees > 6" dbh)	Is Inner Zone Harvest Permitted ?	Prescription
<60 sq. ft. /acre and <100 trees/acre	No	Not applicable.
<60 sq. ft. /acre and >100 trees/acre	Yes	Leave at least 100 trees/acre; the 100 trees/acre must contain the 50 largest trees/acre; other restrictions on leave trees also apply.
>60 to 110 sq. ft. /acre	No	Not applicable.
>110 sq. ft. /acre	Yes	Leave at least 50 trees/acre and a basal area of at least 60 sq. ft./acre; the 50 trees/acre must contain the 21largest trees/acre; other restrictions on leave trees also apply.

Table 2-9. Inner Zone Harvest Prescriptions for the Mixed Conifer Habitat Type

Site Index	Inner Zone Basal Area (trees >6" dbh)	Is Inner Zone Harvest Permitted ?	Prescription
Low (<90)	<70 sq. ft./acre and >120 trees/acre	Yes	Leave at least 120 trees/acre; the 120 trees/acre must contain the 50 largest trees/acre; other restrictions on leave trees also apply.
Low (<90)	70 to 110 sq. ft./ acre	No	Not applicable.
Low (<90)	>110 sq. ft./acre	Yes	Leave at least 50 trees/acre and a basal area of at least 70 sq. ft./acre; the 50 trees/acre must contain the 21largest trees; other restrictions on leave trees also apply.
Medium (90-110)	<90 sq. ft./acre and >120 trees/acre	Yes	Leave at least 120 trees/acre; the 120 trees/acre must contain the 50 largest trees/acre; other restrictions on leave trees also apply.
Medium (90-110)	90 to 130 sq. ft./ acre	No	Not applicable.
Medium (90-110)	>130 sq. ft. /acre	Yes	Leave at least 50 trees/acre and a basal area of at least 90 sq. ft./acre; the 50 trees/acre must contain the 21largest trees; other restrictions on leave trees also apply.
High (>110)	<110 sq. ft./acre and >120 trees/acre	Yes	Leave at least 120 trees/acre; the 120 trees/acre must contain the 50 largest trees/acre; other restrictions on leave trees also apply.
High (>110)	110 to 150 sq. ft./ acre	No	Not applicable.
High (>110)	>150 sq. ft./acre	Yes	Leave at least 50 trees/acre and a basal area of at least 110 sq. ft./acre; the 50 trees/acre must contain the 21largest trees; other restrictions on leave trees also apply.

Two other factors that must be considered relate to down wood and stream-adjacent parallel roads. At least 20 tons of down wood per acre must be left behind, with restrictions on size. Also, when a stream-adjacent parallel road is present in the inner zone, and the minimum required basal area cannot be met due to the presence of the road, then inner zone harvest is restricted based on the stream size and the proximity of the road to the stream.

High Elevation Habitat Type. RMZ widths are as defined in Tables 2-6 and 2-7 above. Restrictions on harvest within the inner zone for RMZs in eastern Washington high elevation habitat types are as defined for western Washington RMZs. However, only

Option 1 is permitted because the narrower core and inner zone widths in eastern Washington do not make Option 2 feasible.

Two other factors that must be considered relate to down wood and stream-adjacent parallel roads. At least 30 tons of down wood per acre must be left behind, with restrictions on size. Also, when a stream-adjacent parallel road is present in the inner zone, and the minimum required basal area cannot be met due to the presence of the road, then inner zone harvest is restricted based on the stream size and the proximity of the road to the stream.

Stream-adjacent Parallel Roads. As is the case for western Washington, the presence of stream-adjacent parallel roads within the inner or core zone also affects the amount of timber that can be harvested. The shortfall of basal area due to these factors has to be accounted for by reducing harvest or implementing an acceptable LWD placement plan.

Wildlife Reserve Trees. All wildlife reserve trees (WRTs) are to be retained in the inner zone, providing they are not a safety hazard. Live WRTs can count towards leave tree requirements.

Outer Zone

This zone has three categories based on timber habitat type: Ponderosa pine, mixed conifer, and high elevation. The width of this zone is 0 to 55 feet depending on the site class and stream width.

Tree counts that must be left per acre, regardless of the presence of an existing stream-adjacent parallel road in the zone, are as follows:

- Ponderosa pine habitat type—10 dominant or codominant trees.
- Mixed conifer habitat type—15 dominant or codominant trees.
- High elevation habitat type—See requirements for western Washington Type S and F waters.

An additional restriction for trees in the high elevation habitat type is that they must be left on the landscape according to one of two strategies: dispersal or clumping strategies.

Eastern Washington—Type N Waters

In eastern Washington, RMZs for Type N waters are defined in two ways. First, an ELZ is defined for all Type N waters. Second, a buffer is required for Type N perennial streams. These are described below.

Equipment Limitation Zones—Type N Waters

The area between the bankfull width edge of a Type N water and a line 30 feet from such edge will be established as an ELZ. Landowners must mitigate for the disturbance of more than 10 percent of the soil within any ELZ as a result of the use of ground-based equipment, skid trails, stream crossings (other than road crossings) or partially suspended cabled logs.

BUFFERS—TYPE N PERENNIAL WATERS

For Type N perennial streams, within 50 feet of the bankfull width, the landowner must identify either a partial cut and/or clearcut strategy for each unit to be harvested as follows:

- For partial cuts—Basal areas must meet the timber-type-dependent basal areas required for the eastern Washington RMZ inner zone. The trees to be included in the basal area determination and left after harvest must include the 10 largest trees per acre, an additional 40 trees must be greater than or equal to 10 inches dbh or must be the largest of the remaining trees, and the other remaining 50 trees also have size and other restrictions.
- For clearcuts—The streamside boundary of the clearcut must not exceed 30 percent of the total stream reach in the harvest unit, must not exceed 300 continuous feet in length, must not be located within 500 feet of the intersection of a Type S or F water, and must not occur within 50 feet of a defined sensitive site. Also, the landowner must simultaneously designate a no-cut zone buffer that is equal in area to the clearcut portion of the stream reach in the harvest unit.

Additionally, if a road exists in an RMZ for a Type N perennial water and the basal area required to be left cannot be met within 50 feet of the stream due to the presence of the road, then the shortfall of basal area has to be eliminated by shifting the RMZ location according to specified rules.

Riparian Management Zones for Exempt 20-acre Parcels

On parcels of 20 contiguous acres or less, landowners with total parcel ownership of less than 80 forested acres do not have to leave the riparian buffers described above. These landowners are subject to the permanent RMZ rules in effect as of January 1, 1999, plus an additional 15 percent volume. ESHB 2091 gave the Forest Practices Board the authority to make this extra leave-tree requirement.

WESTERN WASHINGTON RMZS FOR EXEMPT 20-ACRE PARCELS

RMZs are measured from the bankfull width of a Type S or F water and extend to the line where vegetation changes from wetland to upland plant community, or the line required to leave sufficient shade, whichever is greater. RMZs must be at least 29 feet wide and no wider than the widths shown in Table 2-10. The RMZ width is expanded as necessary to include wetlands or ponds adjacent to the stream.

Within the RMZ, trees are to be left for wildlife and fisheries habitat, as provided for in Table 2-10. Fifty percent or more of the trees are to be live and undamaged on completion of the harvest. The leave trees are to be randomly distributed where feasible; some clumping is allowed to accommodate operational considerations.

Table 2-10. Western Washington Riparian Leave Tree Requirements for Exempt 20-acre Parcels

Water Type/ Average Width	RMZ Maximum Width	Ratio of Conifer to Deciduous/Minimum Size Leave Trees	# Trees/1,000 ft. each side	
			Gravel/Cobble <10" Diameter	Boulder/Bed rock[2]
Types S and F water 75 feet and over	115 feet	Representative of stand	58 trees	29 trees
Types S and F water under 75 feet	86 feet	Representative of stand	115 trees	60 trees
Type F water 5 feet and over	58 feet	2 to 1/12 inches or next largest available[1/]	86 trees	29 trees
Type F water less than 5 feet	29 feet	1 to 1/6 inches or next largest available[1/]	29 trees	29 trees

1/ "Or next largest available" requires that the next largest trees to those specified in the rule be left standing when those available are smaller than the sizes specified.
2/ Ponds or lakes which are Type S or F waters shall have the same leave tree requirements as boulder/bedrock streams.

An average of five undisturbed and uncut wildlife trees per acre are to be left at the ratio of one deciduous tree to one conifer tree equal in size to the largest existing trees of those species within the zone. Other specific requirements exist and the trees left according to this requirement may be included in the number of required leave trees in Table 2-11.

Table 2-11. Down Wood Guidelines for Salvage Logging in Western Washington and Eastern Washington High Elevation Habitat Type RMZ Inner Zones

Structural Class I & II (Scale I-III)	< 1 foot Diameter	1-2 foot Diameter	> 2 foot Diameter	Total
Number of logs/acre	85	83	26	194

For clearcuts of 20 acres or less, if the area in RMZs for Type S or F waters or WMZs, considered together, comprises 10 percent or more of the harvest unit, then not less than 50 percent of the trees required in Table 2-11 is to be left.

EASTERN WASHINGTON RMZS FOR EXEMPT 20-ACRE PARCELS

RMZs are measured as for western Washington except the minimum and the maximum widths are as described below, provided that the RMZ width shall be expanded as necessary. Within the RMZ, trees are to be left for wildlife and fisheries habitat (see below). The condition of the trees and their distribution are to follow the requirements for western Washington.

The width of the RMZ is based on the adjacent harvest type as follows:

- Partial cutting—The RMZ width ranges from 35 to 58 feet on each side of the stream.
- Other harvest types—The RMZ width is an average 58 feet and ranges from 35 to 345 feet on each side of the stream.

Specific leave-tree requirements within the RMZ of Type S or F waters include the following: a) leave all trees 12 inches or less dbh; b) leave 18 live conifer trees between 12

inches and 20 inches dbh per acre; and c) a number of other specific leave-tree requirements. The minimum total leave-tree requirements per acre for Type S and F waters are as follows:

(a) On streams with a boulder/bedrock bed, the minimum leave tree requirement is 75 trees/acre, 4 inches dbh or larger.
(b) On streams with a gravel/cobble (less than 10 inches in diameter) bed, the minimum leave-tree requirement is 155 trees/acre, 4 inches dbh or larger.
(c) On lakes or ponds, the minimum leave-tree requirement is 86 trees/acre, 4 inches dbh or larger.

Finally, for harvest units of 20 acres or less, if the area in RMZs for Type S or F waters or WMZs, considered together, comprises 10 percent or more of the harvest unit, then not less than 50 percent of the trees required above is to be left.

RIPARIAN LEAVE TREES FOR TYPE N WATERS ON EXEMPT 20-ACRE PARCELS

Trees are to be left along Type N perennial waters where such practices are necessary to protect public resources. Where such practices are necessary, at least 29 conifer or deciduous trees, 6 inches dbh or larger, are to be left on each side of every 1,000 feet of stream length within 29 feet of the stream. The leave trees may be arranged to accommodate the operation.

Shade Requirements to Maintain Water Temperature

DETERMINATION OF ADEQUATE SHADE

The method described below is to be used to determine appropriate shade levels for flowing Type S and F waters within 75 feet of the bankfull width or CMZ of the stream, whichever is greater, to prevent excessive water temperatures which may have detrimental impact on aquatic resources.

For the bull trout range in eastern Washington, all available shade will be retained within 75 feet of bankfull width or CMZ of the stream.

TEMPERATURE PREDICTION METHOD

In addition to the RMZ requirements, leave trees are retained in RMZs on flowing Type S and F waters as provided by a specified method (described in the Forest Practices Board Manual), which includes the following considerations:

a) Minimum shade retention requirements

b) Regional water temperature characteristics

c) Elevation

d) Temperature criteria defined for stream classes in chapter 173-201A WAC

LEAVE-TREE REQUIREMENTS FOR SHADE

The method described above is used to establish the minimum required shade cover based on site-specific characteristics. When site-specific data indicate that pre-harvest conditions

do not meet the minimums established by the method, no additional shade removal from RMZs is allowed.

No tree may be harvested from the inner zone of any Type S or F water if, according to the temperature prediction method, the tree is providing shade to the typed water. These shade requirements must be satisfied whether or not the inner zone includes a stream-adjacent parallel road. However, nothing precludes or limits the harvest of shade trees in connection with the construction and maintenance of road crossings or the creation and use of yarding corridors.

Salvage Logging within RMZs

Salvage logging within an RMZ is based upon the zone (core, inner, or outer) in which the tree was originally located, applicable riparian stand requirements, and the extent of previous harvest activities in the zone.

SALVAGE LOGGING WITHIN THE BANKFULL WIDTH OF ANY TYPED WATER

No salvage may take place within the bankfull width of any typed water.

SALVAGE LOGGING IN A CORE ZONE OR CHANNEL MIGRATION ZONE

No salvage may take place within the RMZ core zone or a CMZ, including any portion of those trees that may have fallen outside of these zones.

SALVAGE LOGGING IN THE INNER ZONE

Salvage may not take place within the inner zone if the stand requirements cannot be met by the residual stand. If the proposed salvage involves down tree(s) that originated from the inner zone, salvage of down wood may only be permitted if the down wood was not needed to meet stand requirements in the inner zone. Salvage of any existing down wood may not take place if the unremoved balance of down wood is insufficient to meet the regional down wood guidelines in Tables 2-11 and 2-12. Salvage within the inner zone must be conducted to protect residual undamaged trees. Down wood guidelines for salvage in RMZ inner zones are given in Table 2-11 for western Washington and in Table 2-12 for eastern Washington.

For eastern Washington, RMZ inner zones would have down wood requirements for any timber harvest, whether it is salvage or not (see above). Table 2-12 summarizes these general down wood requirements.

Table 2-12. Down Wood Requirements for all Timber Harvest in Eastern Washington RMZ Inner Zones

Habitat Type	Down Wood Requirements
Ponderosa Pine	Leave at least 12 tons/acre of down wood, including at least six pieces >16 inches in diameter and 20 feet long, and four pieces >6 inches diameter and 20 feet long.
Mixed Conifer	Leave at least 20 tons/acre of down wood, including at least eight pieces >16 inches in diameter and 20 feet long, and eight pieces >6 inches in diameter and 20 feet long.
High Elevation	Leave at least 30 tons/acre of down wood, including at least eight pieces >16 inches in diameter and 20 feet long, and eight pieces >6 inches in diameter and 20 feet long.

SALVAGE LOGGING IN THE OUTER ZONE

Salvage may not take place within the outer zone if the leave-tree requirements cannot be met by the residual stand. If the proposed salvage involves down trees that originated from the outer zone, salvage may only be permitted if the down wood was not needed to meet leave-tree requirements in the outer zone.

Cable Yarding

No timber is to be cable-yarded in or across Type S or F waters except where the logs will not materially damage the bed of waters, banks, or RMZs. If yarding across Type S and F waters is permitted, aerial methods must be used, and an hydraulics project approval (HPA) is required from WDFW. Yarding corridors must be no wider or more numerous than necessary to accommodate safe and efficient transport of logs. Generally, yarding corridors must be located no closer to each other than 150 feet and must be no wider than 30 feet. Additional specifications on yarding are also required.

2.4.2.3 Unstable Slopes

Under Alternative 2, unstable slopes are specifically defined by slope gradient and geomorphic feature (i.e., convergent headwalls, inner gorges, bedrock hollows, toes of deep seated landslides, groundwater recharge areas for glacial deep-seated landslides, outer edge of a meander bend along a valley wall, or a high terrace in a CMZ). After a forest practices application is made, and unstable slope screens are applied, field verification may take place by a DNR forester. If the application is classified as a Class IV-Special (see Section 1.4.1 for a description) because of unstable slopes, the landowner must submit a geotechnical evaluation prepared by a qualified expert of the unstable slopes. If the high hazard unstable slope has the potential to deliver sediment to a public resource or to threaten public safety, the application would be processed as a Class IV-Special. SEPA requirements would have to be fulfilled for any Class-IV application submitted to DNR.

Additional high hazard areas in certain regions of the state would be identified in the future and included in the high hazard landform list to be identified in forest practice applications. Moderate hazard landforms and appropriate management guidelines for forest practices on those landforms would be developed.

2.4.2.4 Forest Roads

Under Alternative 2, there have been substantial changes to forest road management, design, and construction. The policy regarding forest roads has changed from one of prescriptive standards to a performance-based standard of protection of water quality and fish habitat. The new rules provide standards and BMPs that are intended to help landowners design and maintain roads that reduce sediment delivery to streams. Rule changes designed to meet this policy objective include new road location and design and new road and landing construction requirements. Some of these include the following:

- Improved standards on Type 4 and Type 5 stream crossings. Future improvements in standards for Type 4 and Type 5 stream crossings developed jointly between the adaptive management program and WDFW have the goal of being sufficiently protective to eventually eliminate the need for an HPA.
- Culverts must be designed or replaced (if necessary to protect public resources) to pass a 100-year flood rather than a 50-year flood, with consideration for the passage of debris likely to be encountered.
- Closer spacing of ditch relief culverts to minimize runoff to streams.
- Required erosion control for new roads where there is a potential for soil to enter a stream.
- No sidecast construction within the 100-year floodplain.

In addition, road maintenance and abandonment plans would be required for all landowners. Landowners with less than 500 acres of land would have to submit a plan for their ownership with its first forest practices application under the Alternative 2 rules. Those landowners with more than 500 acres of land will have 5 years to produce road maintenance and abandonment plans for their entire ownership. Road maintenance and abandonment identified in the plans must be accomplished by 2015. The road maintenance and abandonment plans are intended to repair and/or maintain fish passage (i.e., culverts), reduce sediment-laden road drainage, reduce potential mass wasting of roads, and improve hydrologic continuity. Sites would be prioritized for repair based on the road assessment. As part of the road maintenance and abandonment plans, landowners would submit standard road practices; pre-storm planning, emergency, and post-storm restoration practices; an inventory of risk to public resources; and a detailed work plan.

An inventory and assessment of orphan road for all landowners has to be completed by 2005. Orphan roads are roads that were constructed prior to 1974 and not used since 1974 for forest practices. Following the assessment, an evaluation would be conducted to determine if repairs and abandonment of orphan roads should occur. The question of whether it would be necessary to request public funding for repairs and abandonment of orphan roads would also be considered.

2.4.2.5 Wetlands

For Alternative 2, changes to current rules (Alternative 1) have been proposed to increase protection of wetlands, primarily through refinements in wetland mapping as well as assessment and protection of forested wetland functions. As part of the improvements

proposed for wetland mapping under this alternative, landowners would have to map all forested wetlands that are 3 or more acres in size. Further, they would have to identify and map all forested wetlands and Type A and B wetlands where more than 0.1 acre of such wetlands would be impacted by filling. They would also have to identify and map all forested wetlands within RMZs, regardless of size. Filling or draining more than 0.5 acre of a wetland would require replacement be substitution or enhancement of the lost wetland function. Replacement would generally be on a two-for-one basis. The current rule requiring a mitigation sequence for road and landing construction in wetlands would also be clarified under this alternative such that mitigation would be determined on the basis of "no net loss" of wetland functions.

DNR would also incorporate wetlands into a specific GIS layer. In addition, a wetlands working group would be established to conduct research and, through the adaptive management process, provide recommendations directed at improving protection of forested wetlands. If an assessment by the wetlands working group indicates that harvest impacts cannot be adequately mitigated or recovered and that changes in the forest practices rules should be considered, adaptive management would be used for developing additional or refining current rules to provide adequate protection of such wetlands.

2.4.2.6 Watershed Analysis

As for Alternative 1, watershed analysis under Alternative 2 would be voluntary for private landowners and mandatory for the state (DNR). However, a number of changes to the existing watershed analysis process (Alternative 1) have been proposed under Alternative 2 as follows:

- Two new modules would also be added to the watershed analysis process: cultural resources and stream restoration.
- Resource assessments would still be required for all current modules, but no prescription process would be required for riparian function, mass wasting, and surface erosion (roads); however, the mass wasting and surface erosion prescriptions would be phased out only after unstable slopes are mapped in each basin, and road maintenance and abandonment plans are completed by landowners.
- SEPA analysis on a non-project basis would be required for all watershed analyses.
- Any landowner within a watershed administrative unit (WAU) would be allowed to apply for a multiyear permit to conduct forest practices according to the watershed analysis prescriptions where 5-year reviews are conducted. Within 30 days of completion of the 5-year review of the assessment and prescriptions, the landowners would have to update the current multiyear permit by including any prescription changes. If necessary, the proposed forest practices in the permit would be modified to comply with the new prescriptions.
- Improvements would be made to the hydrology and water quality modules. For hydrology, an eastside-specific hydrologic assessment process would be developed. For water quality, improvements would be made so that water quality meets Clean Water Act requirements, with particular emphasis on water temperature.

- If a road maintenance and abandonment plan has not been developed for a landowner within a WAU, then the watershed analysis surface erosion resource assessment would provide information for the development of such a plan. If a road maintenance and abandonment plan has been developed, however, then watershed analysis would simply review/assess the plan, but no new prescriptions would be developed.

2.4.2.7 Adaptive Management

Under Alternative 2, the Forest Practices Board would adopt rules requiring and defining an adaptive management process and establish resource objectives for "aquatic resources" in consultation with TFW. The Forest Practices Board would establish the CMER committee and would designate a Scientific Review Committee (SRC) (also in consultation with TFW) to be accountable for the process. The CMER committee would conduct validation and effectiveness monitoring and research to facilitate achieving the resource objectives. The SRC would provide peer review of CMER's work. As funding allows, DNR would hire an adaptive management program administrator (in consultation with TFW) who would report to the Forest Practices Board.

If any disputes arise during the process, the Forest Practices Board will make the final determination subject to the rights of appeal. Notably, the TFW Policy Group would continue to play a significant role in the adaptive management process on a consensus basis before recommendations are provided to the Forest Practices Board.

2.4.2.8 Forest Pesticides

One of the main goals of Alternative 2 with respect to application of forest pesticides is to ensure that use of pesticides would be managed to meet water quality standards and label requirements and to avoid harm to riparian vegetation. Alternative 2 does not propose any changes to rules regarding use of fertilizers or other forest chemicals beyond pesticides. Recognizing that zero drift and zero entry of aerially applied forest pesticides into water are the goals under this alternative, the rules and Forest Practices Board manual would be amended to implement BMPs designed to 1) eliminate direct entry of pesticides into streams, while minimizing off-target drift and 2) minimize entry of pesticides into riparian zones that would cause significant damage to riparian vegetation. Overall, under this alternative, no pesticides would be applied, regardless of application method, within the core zone of any Type S or F waters, unless specifically required for hardwood or noxious weed control. Aerial application of pesticides would also be prohibited within the inner zones of Type S or F waters and within WMZs. For Type N waters and Type B wetlands less than 5 acres in size , aerial application of pesticides would be prohibited within variable-width buffers, depending on specific wind conditions and application nozzle types. Similar to current rules, ground application of pesticides with power equipment would prohibited within 25 feet of any nonforested wetland or surface water, excluding dry stream segments at the time of application. Also similar to current rules, hand-applied pesticides would only be used on specific targets; however, in contrast to current rules, application of all pesticides (whether hand applied or not) would be prohibited within RMZ core areas.

2.4.2.9 Cultural Resources

Under Alternative 2, the protections provided under Alternative 1 would still be in place. However, the degree of incidental protection provided to cultural resources in riparian habitats and wetlands would be increased in proportion to the increase in the amount of area protected in these habitats under Alternative 2. In addition, a cultural resources module would be added to the state watershed analysis procedures. Thus, cultural resources would receive additional protection in those watersheds which undergo watershed analysis.

2.4.2.10 Hydrology

As for the other alternatives, under Alternative 2, a new eastern Washington hydrology module would be developed to be applied to eastside watersheds that undergo watershed analysis.

2.4.3 Alternative 3

Alternative 3 is representative of the alternatives produced by groups that were not among the authors of the Forests and Fish Report. Separate proposals were made by an environmental caucus (led by the Washington Environmental Council and the Audubon Society) and by the Muckleshoot Indian Tribe, the Yakama Indian Nation, and the Puyallup Indian Tribe. Elements of these proposals are incorporated into Alternative 3.

2.4.3.1 Water Typing

Under Alternative 3, a geomorphic-based system consisting of three water types is recognized as follows:

- Streams with a gradient between 0 and 20 percent—these are channels considered to be important for fish.
- Streams with a gradient between 20 and 30 percent—these are channels considered to be important for coarse sediment storage and as a source of LWD.
- Streams with a gradient greater than 30 percent—these are channels considered to be important because they are prone to channelized landslides and are sources of LWD.

2.4.3.2 Riparian Habitat

This section describes the riparian habitat protection provided by Alternative 3. In addition to this protection, major waterways designated as “shorelines of the state” are given additional protection under the Shoreline Management Act. This additional protection would be the same as that described under Alternative 1 (Section 2.4.1.2).

RMZ Description

Under Alternative 3, buffers are identified along all streams. These zones are measured horizontally from the bankfull width, CMZ, BHZ, or CDZ, whichever is greater. They are generally the same on both sides of the state. Buffer widths are shown in Table 2-13. These are considered no-cut buffers, except for improving riparian function through thinning as defined below.

Table 2-13. Riparian Buffer Widths under Alternative 3

Channel Gradient	Minimum Buffer Width	Expanded Buffers
0 to 20 %	200 ft.	Channel migration zone, Beaver habitat zone[1]
20 to 30 %	100 ft.	Channel disturbance zone[2]
>30%	70 ft.	Channel disturbance zone[2]

1/ BHZ is the area occupied by beaver ponds and adjacent riparian areas that are currently used by beavers or have potential beaver habitat.
2/ CDZ is the area within 30 feet of the lateral extent of an expected channelized landslide.

Limited thinning would be allowed within these buffers, but only in the specific case of converting a hardwood-dominated stand to one that is conifer-dominated (Option 1), or facilitating the development of 200-year-old stand conditions (Option 2). These options are further described below.

No harvest is allowed within 30 feet of the bankfull width in any stand or within the BHZ. In addition, no harvest is allowed of functionally sized wood, which is determined using the method in Bilby and Ward (1989) for stream channels with bankfull widths of 50 feet or less, or the method in Abbe (1997) for channels greater than 50 feet.

All cut trees are to remain within the riparian area, until monitoring reveals the prescriptions are effectively meeting riparian and channel objectives.

Landowners wishing to follow either option would be subject to a Class IV-Special permit, which requires SEPA review. In addition, a monitoring program must be implemented to document conditions within the riparian area and adjacent stream channel prior to and after riparian treatments.

Either option will be limited to 10 percent of the total stream length within an individual ownership over the first 5 years. No more than 20 percent of the total stream length within an individual ownership shall be treated until effectiveness monitoring indicates that riparian and channel goals are being met.

Option 1—Hardwood Conversion

Where converting hardwood-dominated riparian areas to conifer vegetation is necessary, only trees in excess of the 140 largest trees per acre can be harvested.

Option 2—Conifer Stand Development

Where facilitating the development of 200-year stand condition is desired while providing sufficient near-term recruitment potential, a maximum of 15 percent understory conifer removal is permitted.

Salvage Logging within RMZs

Salvage logging within an RMZ under Alternative 3 would be restricted as described for Alternative 2.

Cable Yarding

Cable yarding within an RMZ under Alternative 3 would be restricted as described for Alternative 2.

2.4.3.3 Unstable Slopes

Under Alternative 3, high-hazard unstable slopes would be defined as in Alternative 2; however, one more landform would be added to the high hazard geomorphic feature list; the landform is all planar slopes greater than 80 percent slope. If the high hazard unstable slope has the potential to deliver sediment to a public resource or to threaten public safety, no forest practices would be allowed on the high hazard landform or within 50 feet of the high hazard landform. Moderate hazard landforms would include all slopes greater than 50 percent. Management prescriptions for moderate landforms would be developed.

2.4.3.4 Forest Roads

The rules for forest roads under Alternative 3 would be similar to Alternative 2 in respect to the requirements for new road location and design and new road and landing construction requirements. Road maintenance and abandonment plans would also be required; however, the plans would be implemented by 2010. In addition, under this alternative, there would be no net increase in roads within an ownership or within a basin. Whenever a new road is proposed, an equivalent amount of road on the same property or the same basin would have to be abandoned with the abandonment guidelines in the current rules. Orphan roads would also be inventoried and assessed. In addition, orphan roads would also have to be abandoned using the abandonment guidelines in the current rules.

2.4.3.5 Wetlands

Under Alternative 3, a new hydrogeomorphic wetland classification system would be developed and adopted. In addition, in contrast to current rules that require a variable-width WMZ on nonforested wetlands, fixed-width WMZs would be established on nonforested wetlands under this alternative. Open water wetlands, including bogs, would receive a managed 200-foot buffer, and other nonforested wetlands would receive a 100-foot managed buffer. In forested wetlands, similar to current rules, no WMZ would be established; however, snags, non-merchantable trees, understory vegetation, and 70 percent of the canopy cover would be retained.

2.4.3.6 Watershed Analysis

Under Alternative 3, all aspects of the watershed analysis process would be the same as under Alternative 2. In addition, under Alternative 3, post-watershed analysis monitoring would still be voluntary for those watershed analyses that are completed, but would be required for all new watershed analyses conducted. Likewise, restoration plans for degraded instream and riparian areas with the potential to supply critical habitat requirements would be required in all WAUs.

2.4.3.7 Adaptive Management

Under Alternative 3, the adaptive management process would be linked directly to the Forest Practices Board. The Forest Practices Board would take direct control over all effectiveness and validation monitoring and any research projects needed to answer questions relevant to forest practices. In contrast to TFW, a new stakeholder advisory

committee would be established that does not work on a consensus basis, and opportunities for public participation would occur at all points in the program.

2.4.3.8 Forest Pesticides

Under Alternative 3, three main changes to current forest practice rules would be adopted. First, plants with cultural value specifically would be protected from forest pesticides. Second, hand-application of forest pesticides would be prohibited within 50 feet of all typed waters. Finally, in cases where forest pesticides are necessary to help restore RMZ function, an alternative plan would be needed to proceed.

2.4.3.9 Cultural Resources

Under Alternative 3, the protections provided under Alternative 1 would still be in place. However, the degree of incidental protection provided to cultural resources in riparian habitats and wetlands would be increased in proportion to the increase in the amount of area protected in these habitats under Alternative 3. As for Alternative 2, a new cultural resources module would be added to the state watershed analysis procedures.

2.4.3.10 Hydrology

As for the other alternatives, under Alternative 3, a new eastside hydrology module would be developed to be applied to eastside watersheds that undergo watershed analysis. In addition, a landscape rule would be applied to all applications to limit the amount of early seral land within a watershed in the rain-on-snow zone. The rule would maintain a minimum of two-thirds of lands, by ownership, within the rain-on-snow zone of a basin 1,000 acres or more in size, in stands that are at least 25 years old.

2.5 ALTERNATIVE COMPARISON

A more detailed summary and comparison of the environmental effects of the three alternatives considered in detail is displayed in Table 2-14. These tables show the major conclusions regarding the effects of the alternatives without the supporting rationale. The analyses and rationale supporting these conclusions are provided in Chapter 3, the Affected Environment and Environmental Effects.

Most of the significant differences among the alternatives occur in the width and degree of protection provided in RMZs. For comparison purposes, these RMZ widths and the degree of protection provided are displayed graphically for each alternative on the west side in Figure 2-1 and on the east side in Figure 2-2.

Table 2-14. Summary and Comparison of the Environmental Effects of the Alternatives

(Page 1 of 8)

Criteria	Alternative 1 (No Action = Current Rules)	Alternative 2 (Proposed Action = Forest & Fish Report)	Alternative 3 (Based on the WEC/Audubon and Tribal Proposals)
Sediment			
Road Surface Erosion	Generally a high risk of fine sediment delivery to streams,	Substantial reduction in risk of sediment delivery to streams relative	Similar to Alternative 2, except there would be additional

	except where watershed analysis is applied. Rules are prescriptive and do not directly limit resource damage. In addition, road maintenance and abandonment plans (RMAPs) are generally not required, and rules and BMPs that address road drainage are generally not adequate.	to Alternative 1 because of 1) improved BMPs; 2) implementation of RMAPs by 2015; 3) an outcome-based and enforceable policy statement that requires resource protection. However, if they are to be successful, outcome-based rules require continual monitoring; it is unclear that monitoring under Alternative 2 would be sufficiently integral to ensure the success of the outcome-based system.	reduction in risk of sediment delivery to streams, over the short-term as well as the long-term, due to the requirement of no net increase in forest roads and a shorter time frame for implementation of RMAPs (10 years).
Road-related Landslides	Continued moderate risk of road-related landslides because 1) most landforms with a high potential for mass wasting would be identified during the application process and avoided, but some would be missed and not avoided; 2) the rules and BMPs that address road drainage are inadequate; 3) there are generally no requirements for RMAPs; and 4) road drainage onto unstable slopes is not addressed.	Low to moderate risk of road-related landslides because 1) the unstable slope screening process would be refined; 2) the rules and BMPs that address road drainage would be substantially strengthened; and 3) implementation of RMAPs would be required by 2015. However, road drainage onto unstable slopes is not addressed, but could be added through the adaptive management process.	Similar to Alternative 2, except there would be additional reduction in risk of mass wasting due to the requirement of no net increase in forest roads and a shorter time frame for implementation of RMAPs (10 years). However, road drainage onto unstable slopes is not addressed.
Landslides Related to Timber Harvest	Continued moderate risk of mass wasting because 1) most landforms with a high potential for mass wasting would be identified during the application process and avoided, but some would be missed and not avoided; and 2) there would be minimal incidental protection of unstable areas in RMZs along small steep streams.	Slight to moderate risk of harvest-related landslides delivering to streams because 1) a more consistent screening process would result in the identification and avoidance of a greater majority of unstable landforms than under Alternative 1, and 2) greater incidental protection of unstable areas in RMZs and 100-foot by 100-foot no-harvest buffer at intersections of perennial nonfish-bearing streams.	Similar to Alternative 2, except there would be much greater incidental protection of unstable areas in RMZs because of greater RMZ widths, especially on steep gradient streams.

Table 2-14. Summary and Comparison of the Environmental Effects of the Alternatives

(Page 2 of 8)

Criteria	Alternative 1 (No Action = Current Rules)	Alternative 2 (Proposed Action = Forest & Fish Report)	Alternative 3 (Based on the WEC/Audubon and Tribal Proposals)
Hillslope Erosion Related to Timber Harvest	Nearly full protection from hillslope erosion reaching fish-bearing streams. A relatively high risk of sediment delivery because of lack of RMZs along nonfish-bearing streams; watershed analysis reduces the risk. The equivalent buffer area index (EBAI) for sediment was	Full protection from hillslope erosion reaching fish-bearing streams. A low risk of hillslope sediment entering nonfish-bearing streams. The EBAI for sediment was estimated at an average of 80% for all streams under this alternative.	Full protection from hillslope erosion reaching all streams. The EBAI for sediment was estimated at an average of 100% for all streams under this alternative.

	estimated at an average of 62% for all streams under this alternative.		
Harvest Effects on Bank Stability	Moderate degree of protection of bank stability along fish-bearing streams. Low degree of protection along nonfish-bearing streams.	Full protection of bank stability along fish-bearing streams. Moderate degree of protection along nonfish-bearing streams, which would all have ELZs.	Full protection of bank stability along all streams.
Hydrology			
Timber Harvest Influence on Peak Flows	Moderate risk of effects on peak flows because they are only addressed through watershed analysis or DNR intervention.	Similar to Alternative 1 in terms of risk of effects on peak flows, because landowners would have less incentive to conduct watershed analyses; however, road drainage would be improved.	Lowest risk of effects on peak flows, relative to Alternative 1, because of landscape rule limiting cumulative harvest in rain-on-snow zones.
Road Influence on Peak Flows	Moderate risk of effects on peak flows because the rules would not reduce road drainage into streams and due to the extent of road-building in areas without watershed analysis.	Reduction in risk of road influence on peak flows due to improved rules and BMPs related to road drainage and implementation of RMAPs by 2015.	Similar to Alternative 2, except additional reduction in risk due to requirement of no net increase in forest roads and a shorter time frame for implementation of RMAPs (10 years).

Table 2-14. Summary and Comparison of the Environmental Effects of the Alternatives

(Page 3 of 8)

Criteria	Alternative 1 (No Action = Current Rules)	Alternative 2 (Proposed Action = Forest & Fish Report)	Alternative 3 (Based on the WEC/Audubon and Tribal Proposals)
Riparian Habitats			
Effects on LWD Recruitment	High risk of effects on LWD recruitment potential along fish-bearing streams, except along some Type 1 streams where the SMA provides supplemental protection. EBAI for LWD (based on a site class II stand) was estimated at 38 to 48% of full recruitment potential for fish streams on the west side and 20 to 27% on the east side. Very low LWD recruitment potential on nonfish-bearing streams.	The risk of diminished LWD recruitment along fish-bearing streams would be low on the west side and moderate on the east side (potentially high on the east side outside the bull trout range). Risk along nonfish-bearing streams would be moderate to high for perennial streams and high for seasonal streams on both the west side and east side. Less protective rules specific to small landowners would produce an increased level of concern. There is a high degree of uncertainty regarding the effect of diminished LWD recruitment in small nonfish-bearing streams on downstream fish habitat. EBAI for LWD (based on a Class II stand) was estimated at 81 to 96% of maximum recruitment potential for fish streams on the westside and 54 to 73% on the east side. Long-term modeling showed that the best management option for long-term LWD production depends on size of stream and site class of riparian stand.	Low risk of effects on LWD recruitment potential due to increased RMZ widths, addition of CMZs, BHZs, and CDZs, and prohibition of harvest. EBAI for LWD (based on a Class II stand) was estimated at 95 to 100% of full recruitment potential for fish streams. High LWD recruitment potential would occur along nonfish-bearing streams.
Effects on Stream Shade	Moderate to high risk of diminished shade along fish-bearing streams and a very high risk along nonfish-bearing streams.	Low to moderate risk of diminished shade along fish-bearing streams, moderate risk along perennial nonfish-bearing streams, and high risk along seasonal nonfish-bearing streams. Less protective rules specific to small landowners would produce an increased level of concern.	Low risk of diminished shade along fish-bearing and nonfish-bearing streams.
Effects on Leaf and Needle Litter Production	Moderate risk of diminished leaf and needle litter recruitment along fish-bearing streams and very high risk along nonfish-bearing streams.	Low risk of diminished leaf and needle litter recruitment along fish-bearing streams, moderate risk along perennial nonfish-bearing streams, and high risk along seasonal nonfish-bearing streams. Less protective rules specific to small landowners would produce an increased level of concern.	Very low risk of diminished leaf and needle litter recruitment along fish-bearing and nonfish-bearing streams.
Effects on Microclimate	Moderate to high risk of microclimate effects would occur along all streams. Essentially no protection along nonfish-bearing streams.	Moderate risk of microclimate effects would occur along fish-bearing streams and a high to very high risk would occur along nonfish-bearing streams.	Low to moderate risk of microclimate effects along low and moderate gradient streams. Moderate to high risk along high gradient

			streams.

Table 2-14. Summary and Comparison of the Environmental Effects of the Alternatives

(Page 4 of 8)

Criteria	Alternative 1 (No Action = Current Rules)	Alternative 2 (Proposed Action = Forest & Fish Report)	Alternative 3 (Based on the WEC/Audubon and Tribal Proposals)
Wetlands			
Effects on Non-forested Wetlands	Low to moderate risk of impacts associated with harvest adjacent to nonforested wetlands (WMZ width is 25 to 200 feet). No protection for small wetlands (<0.25 acre). Mitigation is required for road/landing development.	Low to moderate risk of impacts associated with harvest adjacent to nonforested wetlands (WMZ width is 25 to 200 feet). No protection for small wetlands (<0.25 acre). Mitigation is required for road/landing development with no net loss in functions.	Low risk of impacts associated with harvest adjacent to nonforested wetlands (WMZ width is 100 to 200 feet). No protection for small wetlands (<0.25 acre). Mitigation is required for road/landing development with no net loss in functions.
Effects on Forested Wetlands	Harvest of forested wetlands is permitted with some exceptions. Limited protection to forested wetlands is provided incidentally in RMZs and WMZs. Mitigation is required for road/landing development.	Similar to Alternative 1, except forested seeps and springs with connections to perennial nonfish-bearing streams are protected. Slightly greater incidental protection is provided in RMZs and WMZs than under Alternative 1. Mitigation is required for road/landing development with no net loss in functions.	High degree of protection because minimum of 70% canopy closure along with understory, snags, and non-merchantable timber is to be retained. Higher incidental protection is provided in RMZs and WMZs than under Alternative 2. Mitigation is required for road/landing development with no net loss in functions.
Water Quality			
Effects on Water Temperature	Low to moderate risk of stream temperature increases along fish-bearing streams. The lack of RMZs along nonfish-bearing streams would result in high overall risk of stream temperature effects.	Low risk of stream temperature increases along fish streams and a moderate to high risk along nonfish-bearing streams. However, the magnitude of the effect of temperature increases in nonfish-bearing streams on fish streams, has high uncertainty and could be important in watersheds with a high degree of past harvest.	Low risk of stream temperature increases along all streams.
Effects on Sediment Levels	Generally a high risk of sediment-related water quality impacts to streams, except where watershed analysis is applied.	Moderate risk of sediment-related water quality impacts to streams in the short-term and a low to moderate risk in the long-term; there is a moderate degree of uncertainty associated with this conclusion.	Moderate risk of sediment-related water quality impacts to streams in the short-term and a low risk in the long-term; there is a moderate degree of uncertainty associated with this conclusion.
Effects on Contaminant Levels	Low to moderate risk of localized surface water contamination with pesticides. No impacts on ground water expected. Long-term impacts could occur from continued application of persistent	Low risk of localized surface water contamination with pesticides. No impacts on ground water expected. Long-term impacts could occur from continued application of persistent pesticides.	Low risk of localized surface water contamination with pesticides. No impacts on ground water expected. Long-term impacts could occur from continued application of persistent pesticides.

	pesticides.		

Table 2-14. Summary and Comparison of the Environmental Effects of the Alternatives

(Page 5 of 8)

Criteria	Alternative 1 (No Action = Current Rules)	Alternative 2 (Proposed Action = Forest & Fish Report)	Alternative 3 (Based on the WEC/Audubon and Tribal Proposals)
Fish			
Effects of Coarse Sediment on Fish Habitat	Generally high risk of adverse effects on fish habitat in many areas from coarse sediment delivery to streams.	Low to moderate risk of adverse effects on fish habitat in some areas from coarse sediment delivery to streams. In the short term, existing roads would continue to have sediment effects with reductions over time due to RMAPs.	Low to moderate risk of adverse effects on fish habitat in some areas from coarse sediment delivery to streams. In the short term, existing roads would continue to have sediment effects with reductions over time due to RMAPs.
Effects of Fine Sediment on Fish Habitat	Generally high risk of adverse effects on fish habitat in many areas from fine sediment delivery to streams.	Moderate risk of adverse effects on fish habitat in some areas from fine sediment delivery to streams	Low to moderate risk of adverse effects on fish habitat in some areas from fine sediment delivery to streams.
Effects of Hydrology on Fish Habitat	Moderate risk of effects on fish habitat from timber management-related increases in peak flows.	Moderate risk of effects on fish habitat from timber management-related increases in peak flows. Watershed analysis would likely be conducted with less frequency and no other rules would directly address cumulative watershed harvest; however, road drainage to streams would be reduced relative to Alternative 1.	Low risk of effects on fish habitat from timber management-related increases in peak flows.
Effects of Large Woody Debris (LWD) on Fish Habitat	High risk of effects on fish habitat due to diminished LWD recruitment in both fish-bearing and nonfish-bearing streams. No active wood placement strategies are available for meeting short-term LWD needs in fish-bearing streams.	Low risk of effects on fish habitat due to diminished LWD recruitment in fish-bearing streams on the westside. Moderate risk of effects on the eastside (potentially high outside the bull trout range). Moderate to high risk of diminished recruitment in nonfish-bearing streams. There is a high degree of uncertainty regarding the effect of diminished LWD recruitment in these small streams on fish habitat in downstream fish-bearing streams. Active wood placement strategies are important for meeting short-term LWD needs in fish-bearing streams.	Low risk of effects on fish habitat due to diminished LWD recruitment in both fish-bearing and nonfish-bearing streams. However, no active wood placement strategies would be available to meet short-term needs in degraded streams.

Table 2-14. Summary and Comparison of the Environmental Effects of the Alternatives

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Criteria	Alternative 1 (No Action = Current Rules)	Alternative 2 (Proposed Action = Forest & Fish Report)	Alternative 3 (Based on the WEC/Audubon and Tribal Proposals)
Effects of Leaf and Needle Litter Recruitment on Fish Habitat	Moderate to very high risk of effects on fish habitat due to diminished leaf and needle litter recruitment in both fish-bearing and nonfish-bearing streams. There is a high degree of uncertainty regarding the significance of these effects.	Low risk of effects on fish habitat due to diminished leaf and needle litter recruitment in fish-bearing streams. Moderate to high risk of diminished recruitment in nonfish-bearing streams. There is a high degree of uncertainty regarding the effect of diminished leaf and needle litter recruitment in these small streams on downstream fish habitat and on the significance of reductions.	Very low risk of effects on fish habitat due to diminished leaf and needle litter recruitment in both fish-bearing and nonfish-bearing streams.
Effects on Floodplains and Off-channel Areas	High risk to floodplains and off-channel fish habitats.	Low risk to floodplains and off-channel habitats because of protection for CMZs and wider RMZs than Alternative 1.	Very low risk to floodplains and off-channel habitats because of protection for CMZs, BHZs, and much wider RMZs than Alternative 1.
Effects of Water Temperature on Fish	Moderate risk of adverse effects on fish due to temperature increases in fish-bearing streams. There is a high degree of uncertainty regarding the effect of temperature changes in small streams on temperatures in downstream fish-bearing streams.	Low to moderate risk of adverse effects on fish due to temperature increases in fish-bearing streams. There is a high degree of uncertainty regarding the effect of temperature changes in small streams on temperatures in downstream fish-bearing streams.	Low risk of adverse effects on fish due to temperature increases in fish-bearing streams.
Effects of Forest Chemicals on Fish	Low to moderate risk of localized pesticide contamination of surface waters; ground water contamination would not be expected.	Low risk of localized pesticide contamination of surface waters; ground water contamination would not be expected.	Low risk of localized pesticide contamination of surface waters; ground water contamination would not be expected.
Effects on Fish Passage	Low potential for improvement of fish passage at existing culverts that are passage barriers. Fish passage is protected across new roads. Culvert flow criteria may be too high for trout.	High potential for improvement of fish passage at existing culverts that are passage barriers. Fish passage is protected across new roads. Culvert flow criteria may be too high for trout.	High potential for improvement of fish passage at existing culverts that are passage barriers. Fish passage is protected across new roads. Culvert flow criteria may be too high for trout.

Table 2-14. Summary and Comparison of the Environmental Effects of the Alternatives

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Criteria	Alternative 1 (No Action = Current Rules)	Alternative 2 (Proposed Action = Forest & Fish Report)	Alternative 3 (Based on the WEC/Audubon and Tribal Proposals)
Wildlife			
Effects on Amphibian Microhabitat Variables	High risk for amphibian microhabitat variables (e.g., microclimate, stream temperature, LWD) along larger streams and essentially no protection along smaller streams.	Moderate risk for amphibian microhabitat variables (e.g., microclimate, stream temperature, LWD) along larger streams and high risk along smaller streams.	Low risk for amphibian microhabitat variables (e.g., microclimate, stream temperature, LWD) along larger streams and low to moderate risk along smaller streams.
Effects on Unique Amphibian Habitats	High risk of impacts to refugia and unique habitats for target amphibians.	Low to moderate risk of impacts to refugia and unique habitats for target amphibians.	Low risk of impacts to refugia and unique habitats for target amphibians.
Effects on Other Riparian-associated Wildlife	High risk associated with habitat for most other riparian-associated wildlife.	Low to moderate risk associated with habitat for most other riparian-associated wildlife.	Low risk associated with habitat for most other riparian-associated wildlife.
Fire			
Effects on Risk of Wildfire	Risk of fire initiation and spread would be similar to current conditions.	Risk of fire initiation and spread would be slightly higher than under Alternative 1.	Risk of fire initiation and spread would be moderately higher than under Alternative 2.
Cultural Resources			
Protection of Cultural Resources	Protection afforded through the forest practices application process. Minimal incidental protection of undiscovered resources in RMZs and WMZs.	Protection afforded through the forest practices application process. Significant incidental protection of undiscovered resources in RMZs and WMZs.	Protection afforded through the forest practices application process. Incidental protection of undiscovered resources in RMZs and WMZs would be greater than under Alternative 2.

Table 2-14. Summary and Comparison of the Environmental Effects of the Alternatives

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Criteria	Alternative 1 (No Action = Current Rules)	Alternative 2 (Proposed Action = Forest & Fish Report)	Alternative 3 (Based on the WEC/Audubon and Tribal Proposals)
Cumulative Effects on Aquatic Ecosystem	Cumulative effects on the aquatic ecosystem would be addressed in watersheds that undergo watershed analysis. Cumulative effects would also be addressed through SEPA review for those forest practices applications that are categorized as Class IV-Special. However, cumulative impacts would occur in other watersheds, especially those with high levels of past harvest or other disturbances; the rules under this alternative are not sufficiently protective to prevent cumulative effects in these watersheds.	Cumulative effects on the aquatic ecosystem would be addressed in watersheds that undergo watershed analysis, but only to a limited degree, since riparian and other prescriptions would not be modified as a result of the analysis. In addition, landowner incentive to conduct watershed analysis would be less under Alternative 2, so their rate of implementation would be lower. Cumulative effects would also be addressed through SEPA review for those forest practices applications that are categorized as Class IV-Special. There would be very few other rules that directly address cumulative effects. Although the riparian, forest roads, and unstable slope rules under this alternative would be substantially more protective than under Alternative 1, they are unlikely to be sufficiently protective to prevent cumulative effects in watersheds containing high levels of past harvest or other disturbances. In particular, there is a high degree of uncertainty regarding the potential for cumulative effects relative to the lack of RMZs on many perennial and all seasonal nonfish-bearing streams. This uncertainty is increased in watersheds with a high level of recent past harvest.	Alternative 3 would also address cumulative effects on the aquatic ecosystem to some degree through watershed analysis; again, however, riparian and other prescriptions would not be modified as a result of the analysis and landowners would have less incentive to conduct watershed analyses, thus lowering their implementation rate. Under Alternative 3, some additional rules address cumulative effects (e.g., rule limiting increases in road density, rule limiting cumulative harvest in the rain-on-snow zone) and the riparian rules would be substantially more protective than under Alternatives 1 or 2. Therefore, cumulative effects are unlikely, except in watersheds with the highest level of past harvest or other disturbances.