4.8 Water Quality

Water resources include both surface water and ground water. Although the evaluation of potential impacts on water quality is addressed in various riparian sections, the agencies opted to discuss the general subject here. This section briefly describes the issues of water quality and quantity, and the current water quality status of DNR-managed lands within the HCP planning area. It closes with cross-references to other sections that evaluate the potential water-related environmental consequences of the alternatives.

4.8.1 Affected Environment

The principal influence on surface water movement is the hydrologic regime, which refers to the combined effects on water of climate, soils, geology, topography, and vegetation.

The quantity of surface water is determined by: (1) the amount of precipitation, and, (2) the extent of losses to the atmosphere or to deep percolation into the ground. Precipitation is controlled by climate and is not significantly influenced by forests or their management. Loss to the atmosphere by evaporation and transpiration of plants is a function of climate interacting with vegetation and soils. These functions are influenced by the forest condition. Whether water that has moved through the soil will become surface flow or go into ground water aquifers depends largely on the region's geology. Water movement in natural streams is a function of water volume, channel geometry and channel slope or gradient. In unmanaged forest areas, the most common disturbance is trees and other vegetation entering streams. In places where this debris is temporarily stabilized, flows may back up and increase in depth.

In general, the forests in Washington contain waters of high quality. Sedimentation as a result of natural or man-made forces is the most common cause of degraded water quality. An estimated 80 percent of water quality deterioration is associated with this process. Forest vegetation acts a stabilizing influence that minimizes the effect of sedimentation on water quality.

Sedimentation includes the processes of erosion, sediment transport, and deposition. Deposition is the temporary or permanent stoppage of sediment movement. Surface water quality is not affected if sediment is deposited before reaching a water body. Once sediment reaches streams, deposition can occur several times over. As flow velocities and volumes increase, sediment is moved downstream. If flow volume or velocities decrease, deposition can occur. The amount of sediment suspended or moved along the streambed therefore depends on surface water movement.

Sediment affects water quality in several ways. It creates a turbid (muddy) condition that restricts light in the stream environment. Nutrients combined with, or attached to, the sediment particles are added to surface water. Oxygen-demanding materials associated with sediment can reduce dissolved oxygen content. Sedimentation may also introduce harmful minerals into surface water.

The high absorption capability of forest soils, combined with the uptake of vegetation, does not allow many dissolved solids to be leached and enter surface water. As a result,

surface waters usually have low concentrations of dissolved solids. In the mature forest, the nutrient cycle generally approaches a steady state; only small amounts of nutrients are discharged in the drainage water. Volumes of dissolved solids are therefore usually small in stream flow from forested areas and primarily reflect the area's geology.

Streamside vegetation can also temporarily degrade surface water quality. Water quality in a small stream is often related to the amount of autumn leaves that fall into the stream channel: dissolved oxygen and pH, decrease but water color, specific conductance, iron, magnesium, and bicarbonate ions all increase as more leaves enter the water. Deciduous litter, which is primarily deposited in autumn, decomposes faster than coniferous litter. Water quality is therefore affected to a greater extent by deciduous than coniferous litter.

The temperature of surface water is another quality modified by a forest. Streamside vegetation prevents extreme daily fluctuation in temperature during low flows and high energy input by providing shade and absorbing energy. With lower temperatures, dissolved oxygen concentrations are higher. Temperature is critical for the survival of various fish species, and it can also affect water quality. Algae, for example, bloom in warm water and can interfere with fish habitat and recreation. Changes in water temperature as a result of timber harvesting are typically noted in small rivers and streams.

Ground water means all water below the ground surface. It includes two types of water storage and movement: aquifers and subsurface flow.

Aquifers contain water that has percolated through the soil mantle or channel bottoms; they are geologic formations capable of storing water and allowing its lateral movement. In general, water movement through aquifers is slow and little affected by immediate precipitation. The presence of aquifers is determined by the geology of a region. In western Washington, most of the area underlain by aquifers is in the glaciated Western Washington Lowlands Province and near the coast of the Olympic Peninsula Province. In the forested areas of eastern Washington, aquifers are mostly limited to the vicinity of the channels of major drainages. Most aquifers consist of sedimentary materials; others include basalt formations. They are usually deep below the surface, up to several thousand feet.

Subsurface waters, on the other hand, typically enter the soil and are stopped by an impervious layer of bedrock or consolidated materials. If the land surface is on an incline, lateral movement occurs within or just below the soil. Movement is often rapid and sensitive to immediate precipitation. Subsurface flow is the most common in Washington's forested areas, especially in mountainous areas. Movement of subsurface flow is determined by the topography and characteristics of soil and subsoil. Subsurface flow is also strongly influenced by the forest condition and management activities.

The quantity of ground water at any time is determined by the amount of water percolating through the soil, the amount in storage below the soil surface and in aquifers, and the amount either removed for domestic purposes or entering stream channels and other surface water bodies. Trees and plants remove water from soil by the process of

transpiration. This loss of water in soil creates a moisture content that is less than the maximum amount the soil can hold. When precipitation or snowmelt are absorbed, water is held in the soil until the maximum level of moisture content is reached.

Ground water quality is not as sensitive as that of surface water to forest conditions and management. In general, the quality of ground water in aquifers depends more on aquifer and local geology than on forest influences. Subsurface flows are more sensitive to forest influences. Forest soils serve as excellent filters through which water percolates. Dissolved and suspended solids and organic compounds are filtered or absorbed by forest soil. As a result of this natural filter, ground water recharged from forest land is generally of good quality.

Forested watersheds in Washington are an important source of public water supplies, mostly as surface water. The quality of surface water from state-managed forest land is generally good, making forests a valuable source of drinking water that typically requires little treatment. Activities in forest watersheds can affect public water supplies in two related ways; quantity and quality, which in turn can affect the usable quantity of water. The department manages state forest land in several major watersheds used for public water supplies, including the Sultan, Tolt, and Green River basins in western Washington and Buck Creek watershed in eastern Washington. Whether the department's activities significantly affect public water supplies depends on the proportion of watershed areas managed by the department and the type and timing of activities.

Planning Unit Overview

The following tables (4.8.1-4.8.9) summarize water resources and related influences on water for the nine planning units in HCP area.

Table 4.8.1: Summary of water resources and related influences on DNR-managed lands in the North Puget Planning Unit

(Source: Data compiled from DNR's GIS. Data for unstable hillslopes based on Shaw and Johnson (in press) slope morphology model)

	Length on HCP lands (miles)	Percent of each stream type in the stream network (based on length)	Density on HCP lands (miles per square mile)	Area on HCP lands (acres)	Percent of HCP lands
Streams					
Type 1	90.4	4	.15		
Type 2	16.5	1	.03		
Type 3	177.1	8	.29		
Type 4	426.4	20	.69		
Type 5[1]	1,474.9	67	2.38		
Open Water				1,830	
Land in rain-on-snow zone				151,280	
Roads			1.55		
Unstable Hillslopes				48,426	12

[1] Untyped streams are treated as Type 5 for the purpose of this analysis.

Table 4.8.2: Summary of water resources and related influences on DNR-managed lands in the South Puget Planning Unit

(Source: Data compiled from DNR's GIS. Data for unstable hillslopes based on Shaw and Johnson (in press) slope morphology model)

	Length on HCP lands (miles)	Percent of each stream type in the stream network (based on length)	Density on HCP lands (miles per square mile)	Area on HCP lands (acres)	Percent of HCP lands
Streams					
Type 1	35.1	3	.15		
Type 2	6.3	1	.03		
Type 3	75.6	7	.33		
Type 4	146.4	13	.64		
Type 5[1]	825.4	76	4.83		
Open Water				1,016	
Land in rain-on-snow zone				64,664	
Roads			2.81		
Unstable Hillslopes				12,567	9

[1] Untyped streams are treated as Type 5 for the purpose of analysis.

Table 4.8.3: Summary of water resources and related influences on DNR-managed lands in the Columbia Planning Unit

(Source: Data compiled from DNR's GIS. Data for unstable hillslopes based on Shaw and Johnson (in press) slope morphology model)

	Length on HCP lands (miles)	Percent of each stream type in the stream network (based on length)	Density on HCP lands (miles per square mile)	Area on HCP lands (acres)	Percent of HCP lands
Streams					
Type 1	78.1	2	.17		
Type 2	5.5	<1	.01		
Type 3	179.2	6	.40		
Type 4	488.7	15	1.08		
Type 5[1]	2,524.0	77	5.58		
Open Water				187	
Land in rain-on-snow zone				119,176	
Roads			2.66		
Unstable Hillslopes				32,326	11

[1] Untyped streams are treated as Type 5 for the purpose of analysis.

Table 4.8.4: Summary of water resources and related influences on DNR-managed lands in the Straits Planning Unit

(Source: Data compiled from DNR's GIS. Data for unstable hillslopes based on Shaw and Johnson (in press) slope morphology model)

	Length on HCP lands (miles)	Percent of each stream type in the stream network (based on length)	Density on HCP lands (miles per square mile)	Area on HCP lands (acres)	Percent of HCP lands
Streams					
Type 1	18.4	3	.11		
Type 2	15.8	3	.09		
Type 3	60.3	10	.35		
Type 4	85.2	15	.49		
Type 5[1]	397.2	69	2.28		
Open Water				1,144	
Land in rain-on-snow zone				18,848	
Roads			2.58		
Unstable Hillslopes				10,336	9

[1] Untyped streams are treated as Type 5 for the purpose of analysis.

Table 4.8.5: Summary of water resources and related influences on DNR-managed lands in the South Coast Planning Unit

(Source: Data compiled from DNR's GIS. Data for unstable hillslopes based on Shaw and Johnson (in press) slope morphology model)

	Length on HCP lands (miles)	Percent of each stream type in the stream network (based on length)	Density on HCP lands (miles per square mile)	Area on HCP lands (acres)	Percent of HCP lands
Streams					
Type 1	59.7	2	.16		
Type 2	16.1	1	.04		
Type 3	164.2	6	.44		
Type 4	328.2	12	.88		
Type 5[1]	2,153.0	79	5.77		
Open Water				412	
Land in rain-on-snow zone				16,807	
Roads			2.85		
Unstable Hillslopes				15,370	6

[1] Untyped streams are treated as Type 5 for the purpose of analysis.

Table 4.8.6: Summary of water resources and related influences on DNR-managed lands in the Chelan Planning Unit

(Source: Data compiled from DNR's GIS. Data for unstable hillslopes based on Shaw and Johnson (in press) slope morphology model)

	Length on HCP lands (miles)	Percent of each stream type in the stream network (based on length)	Density on HCP lands (miles per square mile)	Area on HCP lands (acres)	Percent of HCP lands
Streams					
Type 1	1.3	1	.05		
Type 2	0	0	.00		
Type 3	1.3	1	.05		
Type 4	6.6	3	.27		
Type 5[1]	202.8	95	8.28		
Open Water				5	
Land in rain-on-snow zone				11,550	
Roads			2.70		
Unstable slopes[2]					

[1] Untyped streams are treated as Type 5 for the purpose of analysis.
[2] Unstable hillslope calculations were done for the west-side and OESF planning units only.

Table 4.8.7: Summary of water resources and related influences on DNR-managed lands in the Yakima Planning Unit

(Source: Data compiled from DNR's GIS. Data for unstable hillslopes based on Shaw and Johnson (in press) slope morphology model)

	Length on HCP lands (miles)	Percent of each stream type in the stream network (based on length)	Density on HCP lands (miles per square mile)	Area on HCP lands (acres)	Percent of HCP lands
Streams					
Type 1	10.1	2	.08		
Type 2	1.7	0	.01		
Type 3	22.4	5	.18		
Type 4	67.0	15	.53		
Type 5[1]	362.6	78	2.87		
Open Water				41	
Land in rain-on-snow zone				69,779	
Roads			2.38		
Unstable slopes [2]					

[1] Untyped streams are treated as Type 5 for the purpose of analysis.
[2] Unstable hillslope calculations were done for the west-side and OESF planning units only.

Table 4.8.8: Summary of water resources and related influences on DNR-managed lands in the Klickitat Planning Unit

(Source: Data compiled from DNR's GIS. Data for unstable hillslopes based on Shaw and Johnson (in press) slope morphology model)

	Length on HCP lands (miles)	Percent of each stream type in the stream network (based on length)	Density on HCP lands (miles per square mile)	Area on HCP lands (acres)	Percent of HCP lands
Streams					
Type 1	8.3	1	.04		
Type 2	6.6	1	.03		
Type 3	38.7	5	.19		
Type 4	111.9	16	.54		
Type 5[1]	552.0	77	2.67		
Open Water				126	
Land in rain-on-snow zone				97,043	
Roads			2.64		
Unstable slope[2]					

[1] Untyped streams are treated as Type 5 for the purpose of analysis.
[2] Unstable hillslope calculations were done for the west-side and OESF planning units only.

Table 4.8.9: Summary of water resources and related influences on DNR-managed lands in the OESF Planning Unit

(Source: Data compiled from DNR's GIS. Data for unstable hillslopes based on Shaw and Johnson (in press) slope morphology model)

	Length on HCP lands (miles)	Percent of each stream type in the stream network (based on length)	Density on HCP lands (miles per square mile)	Area on HCP lands (acres)	Percent of HCP lands
Streams					
Type 1	87.3	4	.21		
Type 2	44.7	2	.11		
Type 3	285.7	11	.68		
Type 4	261.5	10	.63		
Type 5[1]	1,852.6	73	4.44		
Open Water				500	
Land in rain-on-snow zone				50,375	
Roads			3.21		
Unstable Hillslopes				37,991	14

[1] Untyped streams are treated as Type 5 for the purpose of analysis.

Current Water Quality Status

The Washington Department of Ecology is authorized by the U.S. Environmental Protection Agency (EPA) to regulate water quality in the state; this includes enforcing compliance by landowners in minimizing nonpoint sources of water pollution (e.g., sediment from mass-wasting events) and avoiding exceedance of mean daily water temperatures. The Washington Department of Ecology compiles a list of water-quality-limited streams as required by Section 303(d) of the federal Clean Water Act, and the list is approved by EPA. Tables 4.8.10, 4.8.11, and 4.8.12 provide information on the water quality impairments for each of the planning units within the three major planning subareas. This information is derived from the GIS database for waters classified by the Washington Department of Ecology (1994) as water-quality-impaired.

Table 4.8.10: Water quality-limited streams within (5) West-Side Planning Units

(Source - Washington Department of Ecology, 1994. List of water quality limited streams in Washington State)

	North Puget	South Puget	Columbia	South Coast	Straits
Number of impaired stream segments	19	7	4	12	6
Total miles impaired	43.53	9.89	4.82	11.66	5.54
Miles of streams impaired for: Temperature	24.35	0	3.19	0	1.19
Sediment	1.66	0	0	0	
Fecal coliform	7.99	9.89	1.13	5.74	4.35
Dissolved oxygen	0	0	0	.74	0
Temperature and sediments	88.60	0	0	0	0
Combination of any 3 of 4: (temperature, sediment, fecal coliform, and dissolved oxygen)	.93	0	.50	5.18	0

Table 4.8.11: Water quality-limited streams within (3) East-Side Planning Units

(Source - Washington Department of Ecology, 1994. List of water quality limited streams in Washington State.)

	Klickitat	Yakima	Chelan
Number of impaired stream segments	6	8	1
Total miles of impaired streams	6.62	16.71	0.08
Miles of streams impaired for: Temperature	1.41	14.81	0
Sediment	0	0	0
Fecal coliform	1.65	1.65	0
Dissolved oxygen	0	0	0
Temperature and sediment	3.56	0.25	0.08
Combination of any 3 of 4: (temperature, sediment, fecal coliform, and dissolved oxygen)	0	0	0

Table 4.8.12: Water quality- limited streams within the Olympic Experimental State Forest

(Source - Washington Department of Ecology, 1994. List of water quality limited streams in Washington State.)

Number of impaired stream segments	26
Total miles of impaired streams	58.46
Miles of streams impaired for: Temperature	57.97
Sediment	0
Fecal Coliform	0
Dissolved oxygen	0
Temperature and sediment	0.49
Combination of any 3 of 4 (temperature, sediment, fecal coliform, and dissolved oxygen)	0

The Department of Ecology is directed, through the Clean Water Act, to establish total maximum daily loads (TMDL) for all waters on the list. The total maximum daily load is defined as the sum of all pollutant loads allocated to point and nonpoint sources within a watershed. The TMDL is set such that the loading capacity of an identified water segment is not exceeded.[1] Ecology prioritizes waters for TMDL development by assessing "vulnerability to degradation, extent of beneficial use impairment, availability to technical support, amenability to control the problem through TMDLs, and the degree of public interest" (Washington Department of Ecology 1994). Watersheds are managed on a 5-year cycle, during which time the intent is to meet water-quality standards through monitoring, inspections, TMDL development, permitting, and other pollution-control activities.

4.8.2 Evaluation of Alternatives

Water temperature and sedimentation are the two nonpoint sources of impairment most closely related to forest land management. Soil disturbance, road runoff, reduced shade, and other factors affect water quality. The designation of riparian zones and related management strategies within these zones mitigate adverse affects because riparian vegetation traps sediments, stabilizes banks, and provides shade. Water quantity, or stream flow, and overall hydrology within drainage basins can also be affected by forest land management. These water quality and quantity issues are discussed in the riparian habitat sections (Sections 4.2.3, 4.3.2, and 4. 4.2) of this draft EIS. Additional information related to the No Action alternative is available in the FEIS for DNR's Forest Resource Plan (1992a). In addition to wetlands, watershed analysis, roads, and riparian management zone policies, DNR adopted a landscape planning policy that incorporates this broader watershed perspective into forest land management.

[1] DNR and the Washington Department of Ecology currently are pursuing the possibility of satisfying TMDL requirements with the Washington Forest Practices Act watershed analysis methods (WFPB 1995b), in order to delist water-quality-limited streams (J. Schuett-Hames, Washington Department of Ecology, Southwest Regional Office, Olympia, personal commun., 1995; S. Bernath, DNR, Forest Practices Division, Olympia, pers. commun., 1995). This cooperative agreement is contingent on the inclusion of water quality and monitoring modules in the Forest Practices watershed analysis manual, as well as a more comprehensive treatment of Type 4 and Type 5 drainages as nonpoint sources for stream sediment loading and water temperature impacts. DNR's Forest Practices Division is taking the necessary steps toward accomplishing these tasks.

4.9 Cultural Resources

4.9.1 Affected Environment

Many people in Washington State, including Native Americans, value the archeological and historical sites associated with their history and culture. Many Native Americans continue to use local traditional resources and highly value traditional cultural sites.

Native Americans have occupied the Washington landscape for more than 12,000 years. The original inhabitants were descendants of Asian peoples who entered North America via the land bridge that once connected Alaska to Kamchatka and Siberia (Washington Office of Archaeology and Historic Preservation 1989). Archaeological sites have been found from the Pacific coast to the Columbia plateau. Evidence of Washington's prehistory includes ancient tools, remnants of habitation sites, burial grounds, and petroglyphs that provide clues to the lives of these people.

Because of the barrier created by the Cascade mountains, the cultures of Native Americans west of the Cascades differed greatly from those on the east side of the mountains. The tribes west of the Cascades were grouped by anthropologists as "Coast Indians," whereas tribes east of the Cascades were referred to as "Plateau Indians" (Avery 1965). The life of the Coast Indians, including the Salish and Nootka cultural groups, was centered around water. Salmon was not only a major source of food, but also the focus of many ceremonies. The tribes celebrated their spiritual ties to the salmon and paid tribute to them as the foundation of their food supply. The coast peoples ate other kinds of fish, including herring, trout, cod, and shellfish, as well as roots, berries, and nuts. The region provided ample wood for constructing canoes and houses. Coastal tribes used cedar bark to weave clothing and made rain hats and baskets from spruce root and grass fibers.

The coast people fished and hunted along the coast in spring, summer, and fall, living in small temporary encampments. In the winter they gathered together in more permanent villages. The coastal environment, with its plentiful resources, allowed these Native Americans to accumulate a great wealth of clothing, baskets, and food. Often the wealthiest man in the village was chief. The chief usually inherited his wealth in the form of fishing rights at a particularly good spot in the river or the right to pick berries where they were most abundant. A unique feature of some Coast Indian cultures was the potlatch, a grand feast given by a wealthy family at which they gave away their possessions to guests. It took years for the hosts to collect enough food and gifts, such as blankets, jewelry, and baskets, for hundreds of guests.

The lives of the Plateau tribes were somewhat different than the coast people. Because food was less plentiful for the Plateau tribes, they spent much more time securing provisions than the coast tribes. Salmon were also a major food source for these tribes. However, because other kinds of fish were not as plentiful, Plateau tribes supplemented their diet with rabbit, deer, and elk, as well as roots, berries, and nuts. Wood was scarce around the Plateau villages, so shelters were built from poles and animals skins or woven

mats, or pithouses were dug below ground. Caves and natural rock-shelters also provided protection from the elements.

The Plateau tribes did not have the plentiful resources to build up stores of wealth that the coastal tribes did. Chiefs of the Plateau villages were chosen for their wisdom rather than wealth. Sweathouses played an important part in Plateau culture. Most were built from a framework of bent limbs covered with branches, skins, or mats. Sweating in these huts was part of a purification ritual.

Table 4.9.1 shows the nine HCP planning units and the major tribes associated with those lands.

Table 4.9.1: HCP planning units and major tribes associated with those lands

PLANNING UNIT	MAJOR TRIBES
OESF	Makah/Ozette, Quileute, Hoh, Quinalt, Lower Elwha S'Klallam, Jamestown S'Klallam, Port Gamble S'Klallam
Straits	Makah, Lower Elwha S'Klallam, Jamestown S'Klallam, Port Gamble S'Klallam, Skokomish
South Coast	Quinalt, Shoalwater Bay, Chehalis
North Puget	Nooksack, Lummi, Swinomish, Sauk-Suiattle, Stillaguamish, Tulalip, Muckleshoot
South Puget	Suquamish, Muckleshoot, Puyallup, Nisqually, Squaxin Island, Skokomish
Columbia	Yakama, Chinook
Chelan	Yakama
Yakima	Yakama
Klickitat	Yakama

Many archaeological and historic sites lie within the borders of DNR's nine habitat conservation planning units. Table 4.9.2 summarizes the types of sites in each planning unit that are located on or near DNR-managed lands.

Table 4.9.2: Types of archaeological and historic sites within the borders of DNR's nine HCP planning units

(Source - DNR TRAX system)

UNIT	NO. OF SITES	TYPES OF SITES
OESF	11	cemeteries, shipwrecks, homesteads
Straits	13	historic battle ground, lithic debris, mammoth bone[2]
South Coast	33	bridges, railroad and logging camps, ancient campsites and rock-shelters
North Puget	33	rock-shelters, petroglyphs, burial grounds, historic district[3]
South Puget	7	campsites, lithic matter, and railroad camps
Columbia	15	historic city district, ancient caves and petroglyphs
Chelan	3	campsite, burial ground, cairn
Yakima	11	ancient rock-shelters and lithic matter
Klickitat	20	homesteads, camp and village sites, and pictographs

4.9.2. Alternatives

Native American graves and archaeological sites are protected from disturbance under chapters 27.44 and 27.53 RCW. Federal and state laws also protect historic and archaeological sites. The state Office of Archaeology and Historic Preservation maintains a register of these sites. DNR uses a computer-based filing and recording system that allows the department to inventory and retrieve information about sites in a particular area. DNR land managers use the department's Total Resource Application Cross-Reference (TRAX) system in evaluating specific project impacts to ensure that department activities do not damage these sites. The department works closely with tribes and other agencies to keep these records current.

[2]The Manis Mastodon Site, near Sequim, is listed on the National Register of Historic Places.

[3]Part of the Stevens Pass Historic District, which is listed on the National Register, lies within the North Puget Sound Unit.

The department's current procedure is to survey areas and obtain as much information as possible from tribes and other interested parties before a timber sale is executed. The department intends to continue to work closely with tribes to identify historical and archaeological sites. The goal is to prevent timber harvesting and related activities from inadvertently damaging cultural resources.

The department's policy, stated in the Forest Resource Plan, is that the department will establish a program to identify and inventory historic and archaeological sites and protect them at a level which, at a minimum, meets regulatory requirements. This policy reduces the possibility that timber harvest or other department activities will destroy or damage historical or archaeological sites.

DNR's policy ensures that resources are identified within the project area and that the department will analyze the project's effect on the resources and take appropriate measures to ensure that no damage occurs. Mitigating measures may include the modification of practices, physical protection of the resource, data recovery, or similar measures. Where appropriate, additional professional assistance will be obtained. The proposed HCP for DNR's trust lands will not alter this policy or its implementation.

4.10 Economic Analysis of DNR's Habitat Conservation Plan

This section provides an analysis of the economic impact of the proposed HCP alternatives on Washington's economy. This section focuses on changes in employment in the economy as a whole. When analyzing the impacts of changing policies in forest land management, some previous NEPA documents, such as the FSEIS for the President's Forest Plan (USDA and USDI 1994a), have examined the role of nontimber uses such as special forest products, tourism, and recreation. While these issues were raised during the scoping process and considered by DNR in developing the range or alternatives, DNR and the Services do not believe that activities involving use of these resources would differ in the presence or absence of an Incidental Take Permit. As a result, this section does not examine these issues.

Typically, changes in forest management affect many aspects of the regional and national economy. The proposed changes are small relative to the national timber harvest, so changes in prices for timber products and other adjustments in the national economy are not anticipated. Different regions throughout the state that rely on timber from state-managed lands may experience both positive and negative impacts from changes in management of the state's resources. This analysis focuses on timber-related employment and employment income as policy-relevant indicators of the HCP alternatives and their impacts on the region's economy.

Economic Background

Forest products are an important component of Washington's economy. The lumber, wood products, and paper industries provided more than 52,000 of the 336,000 manufacturing jobs in the state in 1993. In comparison, the aircraft manufacturing sector provided 95,000 jobs (Washington State Employment Security 1995). Although manufacturing accounted for only 12 percent of total employment in 1993 (U.S. Department of Commerce 1995), manufacturing activity generates work in other sectors of the economy as companies and workers demand supplies and services. As manufactured products are exported from the region they generate important new income for the state economy.

Some regions of the state are more dependent on forest industries than others. The economy of the Olympic Peninsula is heavily dependent on lumber and wood products. Lumber and paper products are a significant component of the economy of the region west of the Cascades. Regions near Seattle-Tacoma have denser populations and more diverse economies. The economies of regions east of the Cascades are more agriculturally oriented.

In 1990, the forest products industry supplied about half the logs it consumed from its own lands. State-managed lands supplied 16 percent of the logs used, 910 MMbf (DNR 1994c), but this decreased considerably after 1990. The small proportion from state-managed lands is misleading because some regions of the state rely on timber from state-managed lands for a much larger share of their supply. Clallam County sawmills, for example, obtained more than a fifth of their logs from state-managed lands (DNR 1994c).

In 1990, more than a quarter of the logs exported from the Olympic Peninsula were from state-managed lands (DNR 1994c). Mills east of the Cascades relied on state-supplied timber to a lesser extent. However, export of logs from state-managed lands is now prohibited.

The volume of timber sales from state-managed lands has not been very stable. Road building, policy shifts, litigation, and endangered species protection have affected the amount of timber cut. These changes lend perspective to changes anticipated under the HCP. The timber industry has absorbed much larger year-to-year changes in harvest amounts than are anticipated from the implementation of the HCP. The industry is now well adapted to changes in supply, particularly supply from state-managed lands. Implementation of the HCP eliminates a significant source of variation in harvests from state-managed lands.

The forest products industry is highly cyclical. Changes in the national demand for housing and paper products relate closely to the health of the national economy and interest rates. Additionally, timber supply from the Pacific Northwest is sensitive to international markets. Even before the recent controversies over endangered species, the Northwest forest industries were changing. Competition from southern forests and imports, technological changes, and exhaustion of old-growth forests confronted the industry with new challenges (Schamberger et al. 1992). In the past, log production for export provided some "slack" in the production system. Raw log exports would increase or decrease in response to relative price shifts brought on by changes in domestic demand. Timber harvest was somewhat insulated from domestic economic downturns because it had an alternative outlet for its product. Recent legal changes have curtailed exports. As a result, business-cycle effects are felt more quickly at the forest level. A stable but flexible supply of logs from state-managed lands may be able to mitigate these impacts.

Methods

The U.S. Forest Service has developed a series of multipliers based on the number of jobs created and income generated by the harvest of 1 million board feet of timber. Any increase in harvest volume has a direct effect in the timber industry. More people are employed to cut and process logs. The increase also has an indirect effect as mills buy more supplies from other industries and mill employees spend their income in the community. The U.S. Forest Service multipliers show both the direct impact of a change in harvest volume and the indirect change generated by the additional employment in the timber industry. Multiplying the change in harvest volume by the multiplier yields the expected change in employment. Any impacts are linearly related to the change in harvest volume.

Although they are simple to apply, the multipliers embody a number of assumptions about the timber industry and the regional economy. The multiplier must reflect the different uses of the logs to gauge the employment impact accurately. Logs harvested for export generate employment in the forest and shipping docks but not in sawmills or furniture factories. Less processing implies fewer new jobs will be added. In addition,

some regional economies can provide many services and supplies needed by timber mills and workers. In these integrated economies the increased wages may recirculate several times, generating additional income and employment. Contrast the impact of a dollar spent in a grocery store in a remote part of Alaska with one spent in a supermarket in Tacoma. Each probably goes largely to a food wholesaler in Seattle. The Alaskan dollar has left the regional economy after only one transaction. The Tacoma dollar will pay salaries to the wholesaler's employees who will then recirculate it in the regional economy. The Tacoma dollar will generate more income in the region because the economy is more complete. For these reasons, the U.S. Forest Service develops a unique multiplier for each timber harvest region reflecting the use of its timber and the regional economy. In this analysis, the multiplier for the nearest region was applied in each planning unit.

Any multiplier analysis also reflects the technology used during the period in which the multiplier is calculated. The technology in the timber industry has been changing rapidly in recent years. Improved productivity has significantly reduced the number of jobs per board foot produced (Mead et al. 1991, quoted in Schamberger et al. 1992). These changes are likely to continue for the near future. Adjusting the multiplier for technological change is conceptually possible but any adjustment would be speculative at best.

Multipliers are designed to evaluate the short-term changes in harvest volumes associated with 5- and 10-year forest plans. They do not encompass longer term adjustments such as the migration of people or industries. Nor can they capture the impact of new products and price structures. Within the planning horizon of the proposed plans it is easy to imagine the possibility of large shifts of capital and people. Substitution of recycled plastics for logs, and computer monitors for paper, is already changing the dynamics of the lumber and paper industries. When one considers that 200 years ago parchment and the quill pen were advanced communications technology, defending an assumption of no changes in technology or economic structure through the forecast period is difficult. Any economic forecast beyond 40 years should be viewed with the deepest skepticism.

Data provided by DNR are based on 10-year forecast periods. Sustainable harvest calculations suggest the volume of harvest by age class of trees. Annual harvest quantities are required for the multiplier analysis, so 10-year harvest totals were divided by 10. Actual annual harvests will vary because of weather, market conditions, and other events. Employment and income impacts are shown as a range of probable changes to demonstrate the degree of uncertainty about actual harvests.

Results

Tables 4.10.1 and 4.10.2 show the annual harvest levels and associated employment and unemployment income impacts for each alternative analyzed. Estimated harvest levels for the alternatives are divided into two categories: expected and low. The expected harvest levels represent average annual harvest levels based on the projection of DNR-managed land harvest levels for the first decade (see Appendix 5 for a discussion of the assumptions used for the harvest analysis projections). Low harvest levels represent the

possibility of annual negative fluctuations of up to 35 percent for the No Action alternative and 25 percent for Alternative B. It is recognized that future conditions and circumstances may result in higher harvest levels than specified in the expected or low harvest levels used here. However, given the uncertainty typically associated with making such projections, a more conservative approach to the harvest level estimates is probably warranted.

Table 4.10.1 shows that total regional expected annual harvest levels under Alternative B would be 7.1 percent greater than under the No Action alternative. Implementation of Alternative C would result in a decrease of 16.3 percent in annual harvest levels compared with the No Action alternative. Under low harvest levels, Alternative B would result in a 23.5 percent harvest increase over the No Action alternative. Alternative C would result in a decrease of 3.4 percent.

Table 4.10.1: Aggregate harvest levels and timber-related jobs, by alternative

Source: Washington Department of Natural Resources 1996.

	Timber Harvest[1]				
	Alts. A, 1	**Alts. B, 2**	**Percent Change in Harvest Levels[2]**	**Alts. C, 3**	**Percent Change in Harvest Levels[2]**
Expected	724.7	776.0	+ 7.1%	606.9	-16.3%
Low	471.0	582	+ 23.5%	455.2	-3.4%

[1] In millions of board feet

[2] HCP Alternatives compared with Alts. A, 1.

For expected harvest levels, the table shows that job impacts, based on percentage increases, would be concentrated in the east-side and OESF planning units. For the east-side planning units, timber-related employment and income would increase by over 32 percent Alternative B compared with the No Action alternative. For the OESF Planning Unit, employment and income under Alternative B would increase by 42.9 percent. For the west-side planning units, harvest levels and employment would be similar under both alternatives A and B.

Table 4.10.2: Timber-related Job and Income Impacts, by Planning Unit and Alternative

Source: Total timber-related jobs and income are based on response coefficients (jobs and income per million board feet of timber harvest) developed for National Forest timber harvest levels in Washington State. Contact Regional Economist, U.S. Forest Service, Strategic Planning, Region 6 Office, Portland Oregon.

	Total Timber-related jobs[1]					Total Timber-related job income[2]				
	No Action	HCP Option B		HCP Option C		No Action	HCP Option B		HCP Option C	
Unit	Jobs	Jobs	Percent change[3]	Jobs	Percent change[3]	,000 Dollars	,000 Dollars	Percent change[3]	,000 Dollars	Percent change[3]
West Side[4]:										
expected	13,671	13,693	+0.2%	10,777	-21.2%	378,683	377,945	-0.2%	294,805	-22.2%
low	8,886	10,270	+15.6%	8,082	-9.0%	246,144	283,459	+15.2%	221,104	-10.2%
East Side[5]:										
expected	313	415	+32.6%	286	-8.7%	7,084	9,380	+32.4%	6,468	-8.7%
low	204	311	+52.5%	215	+5.4%	4,605	7,035	+52.8%	4,851	+5.4%
OESF:										
expected	938	1,340	+42.9%	579	-38.3%	24,990	35,700	+42.9%	15,427	-38.3%
low	610	1,005	+64.8%	434	-28.8%	16,244	26,775	+64.8%	11,571	-28.8%
Total:										
expected	14,922	15,448	3.5%	11,642	-22.0%	410,757	423,025	3.0%	316,700	-22.9%
low	9,700	11,586	19.4%	8,731	-10.0%	266,993	317,269	18.8%	237,526	-11.0%

[1] Includes direct, indirect and induced employment from associated harvest levels.

[2] Includes direct, indirect, and induced employment income from associated harvest level.

[3] Specified Alternative compared with No Action alternative.

[4] Columbia, Straits, North Puget, South Puget and South Coast planning units.

[5] Chelan, Yakima, and Klickitat planning units.

For low harvest levels, the OESF Planning Unit would have the highest percentage increase for harvest and employment levels under Alternative 2 compared with the No Action alternative. The east-side planning units would have the next highest percentage increase, and the west-side planning units have the smallest increase.

Under the expected harvest projections, Alternative C would result in a decrease in timber-related employment and income for all three areas compared with the No Action Alternative. The west-side would experience a 21 percent decline in employment and income; the east-side about a 9 percent decline and the OESF a 38 percent decline. Under low harvest projections, the east-side would show a 5.4 increase in employment and income compared with the No Action Alternative; the west-side, a 9 to 10 percent decline in employment and income; and the OESF, about a 29 percent decline.

Overall, under expected harvest projections, Alternative B would result in a 3.4 and 3.0 percent increase in timber-related employment and associated income, respectively over the No Action alternative; Alternative C would result in a 22 percent decrease for both employment and income.

Under low harvest projections, Alternative B would result in an increase of 19 percent over the No Action alternative for both employment and income. Alternative C would decrease employment and income around 10 percent.

4.11 Cumulative Effects

4.11.1 Introduction

The cumulative effects analysis addresses the effects of each alternative and their interactions with other reasonably foreseeable actions at the regional level. Cumulative impact is the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonable foreseeable future actions, regardless of the originator of those actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

Each resource assessment section in this DEIS includes at least some discussion of cumulative effects potential related to DNR's No Action and action alternatives as these apply to the five west-side, three east-side and OESF planning units in conjunction with expected actions on federal and private lands and regional recovery plans for threatened and endangered species. This is especially true for the action alternatives because the management strategies were developed with potential cumulative effects as one consideration in determining the potential effectiveness of the strategy for that resource. In addition, a habitat-based assessment is provided in Section 4.5.4. In many ways, that section provides a cumulative effects assessment in respect to overall forest and riparian habitat. Rather than repeat cumulative effects discussions contained in other parts of this document, Section 4.11 will give a brief overview of the cumulative effects contribution anticipated from DNR's No Action and action alternatives.

The discussion in this section, as well as earlier sections, does not address harvest of specific units, construction of specific roads, or other specific management activities that would be undertaken by DNR during normal forest practices. Specific actions like these that are not directly addressed under an alternative would be consistent with DNR's Forest Resource Plan (DNR 1992b), the Washington Forest Practices Act, and other state and federal laws.

4.11.2 Assumptions

DNR's planning area for the proposed HCP coincides with the range of the northern spotted owl. The total area of trust lands covered by the proposed HCP is approximately 1.6 million acres. Actions proposed by DNR would be applied only to DNR-managed lands. However, many other individuals and entities own and manage forest land within this same area, including the federal government (8,826,000 acres), state government (non-DNR) (151,000 acres), city and county government (101,000 acres), tribes (1,015,000 acres), and private individuals and organizations (9,488,000 acres). Potential actions by these other landowners, which would affect the overall quantity, quality, and pattern of forest land and forest habitat within western Washington, are many and highly variable. It is impossible to predict what that aggregate set of actions will be during the next 100 years. Therefore, in an effort to provide a meaningful summary of potential cumulative effects for DNR's actions, one must make some assumptions. These assumptions, based on potential trends rather than specific actions by specific landowners or government entitites, are listed below:

(1) Washington State's population will continue to grow, increasing the already abundant demands for forest lands in this state to do all and be all: providing timber and forest products, jobs, forest refuges for spiritual quests, suitable development land for expansion of society's infrastructure, habitat for all animal, plant and fish species native to Washington, unique settings for a broad range of recreation and outdoor sports, and more.

(2) In light of these demands and the changing winds of law and legislation, landowners and land managers will continue to seek creative ways to increase regulatory certainty.

(3) Large forest landowners and managers, in search of ways to resolve conflict among the many growing demands, will look increasingly toward processes that define a niche for their lands and will create specific, objectives-based plans to achieve them.

(4) Although minor adjustments may be made over time, the President's Forest Plan will provide the general level of long-term protection envisioned at the time of its adoption. As a result, national forests and parks will provide the backbone of forest habitat conservation in Washington State. Other landowners who develop specific conservation strategies will seek to define their niche in relationship to the federal lands in their area, providing themselves the greatest flexibility while also making an effective contribution to overall conservation within the state.

(5) The current shift toward habitat-based conservation, rather than species-by-species conservation, will continue as a result of composite efforts to achieve both regulatory and conservation certainty into the future.

(6) While they will be potentially more dynamic through time than the President's Forest Plan, the cumulative set of habitat conservation plans initiated by private, tribal, municipal, and state landowners and managers will create an increasingly effective, reliable, and integrated network of forest habitat in Washington.

(7) DNR will continue to manage the majority of its forest trust lands as commercial forest, being guided in that management by its responsibilities to each of the trusts. Although some forest land may become designated as transition lands during the Asset Stewardship planning process recently initiated, no significant changes in overall emphasis are expected.

4.11.3 Alternative A and Alternative 1

Conservation under the No Action alternatives (A and 1) is currently achieved on DNR-managed lands on a site-by-site, species-by-species basis under the guidance of the Forest Resource Plan (DNR 1992b) and the Washington Forest Practices Act. Coordination with adjacent landowners' efforts is also site-by-site, rather than at the landscape level. However, policies adopted by the Board of Natural Resources in the Forest Resource Plan (DNR 1992b) are shifting DNR toward a broader approach to forest management through landscape planning, watershed analysis, and other policies. Implementation of these policies is currently in progress.

While this shift will increase the amount of attention given to how DNR-managed lands fit into a landscape context and to potential cumulative effects of individual activities, there is no inherent strategy for achieving clearly defined conservation goals at this broader scale. More specifically, without a defined strategy for managing the nature and pattern of forest and riparian vegetation at a broad regional scale, it is difficult to ensure that positive cumulative outcomes can be accomplished for habitat within the context of commercial forest production and other forest demands. This becomes clear as the various resource assessments contained in Chapter 4 are read. Repeatedly, the No Action alternatives are described as having the potential to provide for various conservation needs, but that this can not be counted upon because: (1) no specific provisions are defined for certain needs; and/or, (2) the quantity, quality, and distribution of resulting habitats are unplanned (e.g., unpredictable movement of owls circles under today's owl circle approach rather than controlled location of habitat based on potential effectiveness and contribution need.)

If habitat were abundant, the cumulative effects might be of less concern. But when some habitats are dwindling and specific characteristics of certain habitat needs are still unknown, the inability to predict whether the cumulative effect will be positive or negative on a landscape level causes concern. There is relatively low certainty as to whether the No Action alternatives will provide positive cumulative effects on the quantity, quality, and distribution of forest habitat in Washington over the next 100 years. The individual resource evaluations suggest, at the least, there will be some gaps in availability of some habitats for some life cycle needs of some species.

4.11.4 Alternative B

West-Side Planning Units

Alternative B provides a landscape-level, habitat-based strategy for providing conservation in western Washington for a broad range of species and habitat types. The primary emphasis is on spotted owls, marbled murrelets, and riparian habitat; however, it is expected that the resulting quantity, quality, and patterns of upland and riparian forests will be effective habitat for many other native species.

The owl strategy, in particular, builds on anticipated federal forest patterns. By identifying the type of effective support DNR-managed lands can contribute, Alternative B has the potential to gain high conservation benefits while maintaining the greatest operational flexibility. It also makes no demands on other nonfederal landowners, since their actions are not essential to ensuring the DNR contribution, but they have the opportunity to identify a niche for themselves in relation to this and the federal strategy that enhances everyone's contribution, thus gaining the same certainty with high flexibility. This should provide greater likelihood of positive cumulative effects for northern spotted owl conservation. This is particularly true if the trend toward habitat-based conservation plans continues as assumed.

The riparian strategy seeks to ensure overall riparian ecosystem function from headwaters to the mouth of all rivers to the extent feasible for a single land manager among many

others within each watershed. This should provide greater certainty of positive cumulative effects for the high number of species that rely on riparian, wetland, and aquatic areas than the No Action alternatives. Although the long-term contribution of marbled murrelet habitat is uncertain, there will be at least some added assurance of older forests across a larger percentage of DNR-managed lands. In addition, due to the multiple-species perspective, Alternative B provides greater certainty that the range of forest successional stages on DNR-managed lands will include older forests, with important unique features and habitats maintained, and be located where they are more strategically effective from a biological perspective.

East-side Planning Units

Because there are so many differences between west-side and east-side ecology, DNR decided to leave most habitat issues in the east-side planning units for future planning efforts. Only the northern spotted owl strategy and other listed species potentially utilizing the east-side planning units' habitat are applied to the east-side planning units. Potential cumulative effects on eastside units related to the spotted owl strategy are described at the end of Section 4.3.1.

4.11.5 Alternative C

Alternative C is similar to Alternative B. Like B, it takes a strategic approach to locating certain habitats and protecting certain unique features and habitat elements. However, it provides greater certainty than either A or B that there will be adequate amounts of older forest, more certain range of desired habitats, and higher protection of riparian forests on DNR-managed lands. At the same time, it also reduces management flexibility. The potential long-term implications of this reduced flexibility in DNR's ability to respond to actions taken by other landowners within the planning area are unclear related to cumulative effects on habitat conservation.

4.11.6 Alternative 2

Like Alternative B for the other planning units, Alternative 2 provides a landscape-level, habitat-based strategy in the OESF for contributing to conservation in western Washington for a broad range of species. The primary emphasis is on spotted owl, marbled murrelet, and riparian ecosystems; however, it is expected that the resulting quantity, quality, and patterns of upland and riparian forests will be effective habitat for many other native species.

While Alternative 1 emphasizes protecting existing habitat for individual species, Alternative 2 is an experimental approach for enhancing the natural growth potential of today's commercial forest and for building habitat into the future. It begins with a habitat-recovery phase, then stabilizes around a habitat-maintenance approach. The nature of riparian, murrelet, and owl habitat targets should ensure a broad distribution of quality, quantity, and types of habitat landscape-by-landscape. While Alternative 2 is less closely tied to support of federal owl sites through fixed zones than Alternative 3, it also allows the greatest flexibility to locate habitat in the most strategic location through time, adjusting more easily to an unpredictable, changing environment.

Alternative 2 includes a research program that will emphasize cooperative efforts with other landowners and land managers. This has the potential to make two strong contributions toward ensuring positive long-term cumulative effects: (1) valuable new knowledge that can be used to improve the effectiveness of the conservation strategies; and, (2) the common ground gained in forest management through partnerships and shared knowledge, rather than independent actions taken without attention to adjacent lands and approaches. At the same time, because Alternative 2 is an experimental approach to achieving habitat-based conservation in a commercial forest, there is greater potential risk. This makes the cumulative outcome less certain than Alternative 3, but still more certain than Alternative 1.

4.11.7 Alternative 3

On the broad scale, Alternative 3 in the OESF is similar to Alternatives B and C for the west-side planning units in that it provides a landscape-level, habitat-based strategy for providing conservation on the Olympic Peninsula and is based on a more traditional zoned approach. It builds on habitat zones designed to provide specific functions for spotted owls in relation to federal lands. The primary emphasis on spotted owl, marbled murrelet, and riparian ecosystems is expected to result in forest and riparian vegetation patterns that provide effective habitat for many other species beyond just these three. Likewise, due to the multiple species emphasis and the careful placement of owl zones, this alternative provides greater certainty that the range of forest successional stages on DNR-managed lands will include older forests and be located where they are most strategically effective. There is greater certainty of positive cumulative effects under Alternative 3 than under Alternative 1.

Unlike Alternative 1, however, Alternative 3 incorporates an aggressive approach to research and gaining new knowledge and to coordinate efforts with other landowners, closer to like Alternative 2. This has the potential to make two strong contributions toward ensuring positive long-term cumulative effects: (1) valuable new knowledge that can be used to improve the effectiveness of the conservation strategies, and (2) the common ground gained in forest management through partnerships and shared knowledge, rather than independent actions taken without attention to adjacent lands and approaches. This also means there is greater potential risk than with Alternative 1 regarding the actual cumulative effects outcome; this risk is lower than with Alternative 2 because Alternative 3 is somewhat less experimental in the approach to achieving habitat through time.

4.11.8 Closing

In 100 years, as a traveler exploring western Washington, would a person be able to tell which alternative had been implemented? It might be difficult to tell the difference at the stand level. What isn't seen may be more significant than what is seen. For example, not seeing overly narrow riparian management areas would be significant. In general, under all the alternatives, the full range of silvicultural activities will still be applied. Under all the alternatives, all the assortment of forest stands seen today will be out there on the landscape. There will be no way to tell whether the stand you're walking through or

looking down upon is the result of any particular alternative. The difference will be pronounced at the landscape level, showing a mosaic of stand treatments that are interwoven, providing lang-term economic and ecological viability. The point is that the differences will be subtle. In fact, the effectiveness of each alternative lies precisely in the cumulative effects of the many small actions that make up that alternative. Alternatives B, C, 2, and 3 offer specific strategies to guide the cumulative effects toward positive outcomes; Alternatives A and 1, because they continue stand-level management in an atmosphere of regulatory uncertainty, permit effects to fall where they may. Alternative C is more conservative than Alternative B in providing for greater certainty of conservation benefits. Alternative 3 is more conservative than Alternative 2 in applying an experimental approach to achieving a habitat-based strategy for integrating production and conservation.

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Dorothy Duncan, *Commissioner, Clallam County*
Gene Dziedzic, General Member
Jerry Franklin, *UW College of Forest Resources*
Vivian Lee, *Hoh Tribe, to 9/95,*
Mary Leitka, *Hoh Tribe, 10/95 to present*
Jill Mackie, *Pacific Lumber and Shipping*
Grant Munro, *industrial forestry*
Bert Paul, *Forks, Washington*
Charles Peterson, *Western Council of Industrial Workers*
Melanie Rowland, *Washington Environmental Council*
Jim Walton, *Washington State Wildlife Commission*
Vim Wright, *UW Institute for Environmental Studies*

OESF Science & Technical Advisory Group for Riparian Conservation Strategy
*Susan C. Shaw, *Geomorphologist, DNR*
Carol Bernthal, *Habitat Coordinator, Point No Point Treaty Council*
Richard Bigley, *Ecologist, DNR*
Chris Byrnes, *Habitat Manager, WDFW*
Ned Currence, *TFW Biologist, Makah Tribe*
Phil DeCillis, *Fish Biologist, USFS*
Jerry Gorsline, *Olympic Field Representative, Washington Environmental Council*
Scott Horton, *Wildlife Biologist, DNR*
Michael McHenry, *TFW Biologist, Lower Elwha S'Klallam Tribe*
Randy Mesenbrink, *Hoh District Manager, DNR*
Beth Naughton, *TFW Biologist, Quileute Tribe*
David Parks, *Hydrologist, DNR*
Ginger Phalen, *Wildlife Biologist, USFWS*
Warren Scarlett, *Fisheries Technician, DNR*
Joanne Schuett-Hames, *Water Quality TFW Coordinator, DOE*
Anne Shaffer, *Marine Biologist and Policy Analyst, Quileute Tribe*
Eric Shott, *TFW Coordinator, Northwest Indian Fisheries Commission*
William Traub, *Natural Resources Engineer, DNR*

Additional input from DNR Olympic Region staff:
Doug Ferris, Regional Engineer,
Rick Cahill, Dave Christiansen,and
Jim Closner, Field Foresters
Mark Johnsen, Ozette District Manager

6. Distribution List

6. Distribution List

Federal

Environmental Protection Agency[1]
National Marine Fisheries Service
National Park Service, Pacific Northwest Region
US Fish and Wildlife Service
US Forest Service, Portland
Olympic National Park

U.S. Senate

The Honorable Slade Gorton
The Honorable Patty Murray

U. S. House of Representatives

The Honorable Norm Dicks
The Honorable Richard Hasting
The Honorable Jack Metcalf
The Honorable Linda Smith
The Honorable Rick White
The Honorable Jennifer Dunn
The Honorable Jim McDermott
The Honorable George Nethercutt
The Honorable Randy Tate

State

California Department of Forestry
Central Washington University Board of Trustees
Eastern Washington University Board of Trustees
The Evergreen State College Board of Trustees
Governor's Timber Team (Washington)
Maryland Forest Service
Oregon Department of Forestry
University of Washington Board of Regents
Washington State Board of Education
Washington State Department of Ecology
Washington State Department of Fish and Wildlife
Washington State Office of Archaeology and Historic Preservation
Washington State Parks and Recreation Commission
Washington State University Board of Regents
Western Washington University Board of Trustees

[1] Names shown in bold and italics will receive a complete set of the HCP and EIS. All others will receive Executive Summaries.

State Legislators

Senator Ann Anderson, Natural Resources Committee
Senator Kathleen Drew, Natural Resources Committee
Senator Jim Hargrove, Natural Resources Committee
Senator Mary Margaret Haugen, Natural Resources Committee
Senator Valoria Loveland, Democratic Caucus Chair
Senator Dan McDonald, Republican Caucus Leader
Senator Bob Morton, Natural Resources Committee
Senator Irv Newhouse, Republican Caucus Floor Leader
Senator George Sellar, Republican Caucus Chair
Senator Sid Snyder, Democratic Caucus Leader
Senator Harriet Spanel, Natural Resources Committee
Vic Moon, Research Analyst, Senate Natural Resources Committee
Cathy Baker, Fiscal Analyst, Senate Natural Resources Committee
Representative Marlin Appelwick, Minority Leader
Representative Clyde Ballard, Speaker of the House
Representative Bob Basich, Natural Resources Committee
Representative Barney Beeksma, Natural Resources Committee
Representative Jim Buck, Natural Resources Committee
Representative Ian Elliot, Natural Resources Committee
Representative Dale Foreman, Majority Leader
Representative Steve Fuhrman, Natural Resources Committee
Representative Bill Grant, Minority Caucus Chair
Representative Brian Hatfield, Natural Resources Committee
Representative Ken Jacobsen, Natural Resources Committee
Representative Lynn Kessler, Minority Whip
Representative Barbara Lisk, Majority Caucus Chair
Representative John Pennington, Natural Resources Committee
Representative Debbie Regala, Natural Resources Committee
Representative Tim Sheldon, Natural Resources Committee
Representative Val Stevens, Natural Resources Committee
Representative Brian Thomas, Natural Resources Committee
Representative Les Thomas, Natural Resources Committee
Representative Bill Thompson, Natural Resources Committee
Karl Herzog, Fiscal Analyst, House Capital Budget Committee
Linda Byers, Research Analyst, House Natural Resources Committee
Nancy Stevenson, Fiscal Analyst, House Appropriations Committee
Bob Longman, Coordinator, House Finance Committee

County

Adams County Commissioners
Adams County Planning Department
Asotin County Commissioners
Asotin County Planning Department
Benton County Commissioners
Benton County Planning Department
Chelan County Commissioners
Chelan County Planning Department
Clallam County Commissioners
Clallam County Conservation District
Clallam County Planning Department
Clark County Commissioners
Clark County Planning Department
Columbia County Commissioners
Columbia County Planning Department
Cowlitz County Commissioners
Cowlitz County Planning Department
Douglas County Commissioners
Douglas County Planning Department
Ferry County Commissioners

County (cont.)

Ferry County Planning Department
Franklin County Commissioners
Franklin County Planning Department
Garfield County Commissioners
Garfield County Planning Department
Grant County Commissioners
Grant County Planning Department
Grays Harbor County Commissioners
Grays Harbor County Planning Department
Island County Commissioners
Island County Planning Department
Jefferson County Commissioners
Jefferson County Planning Department
King County Council
King County Council, Surface Water Mgmt. Division
King County Planning Department
Kitsap County Commissioners
Kitsap County Planning Department
Kittitas County Commissioners
Kittitas County Planning Department
Klickitat County Commissioners
Klickitat County Planning Department
Lewis County Commissioners
Lewis County Planning Department
Lincoln County Commissioners
Lincoln County Planning Department
Mason County Commissioners
Mason County Planning Department
Okanogan County Commissioners
Okanogan County Planning Department
Pacific County Commissioners
Pacific County Planning Department
Pend Oreille County Commissioners
Pend Oreille County Planning Department
Pierce County Council
Pierce County Planning Department
San Juan County Commissioners
San Juan County Planning Department
Skagit County Commissioners
Skagit County Planning Department
Skamania County Commissioners
Skamania County Planning Department
Snohomish County Commissioners
Snohomish County Planning Dept
Spokane County Commissioners
Spokane County Planning Department
Stevens County Commissioners
Stevens County Planning Department
Thurston County Commissioners
Thurston County Planning Department
Wahkiakum County Commissioners
Wahkiakum County Planning Dept
Walla Walla County Commissioners
Walla Walla County Planning Department
Whatcom County Council
Whatcom County Planning Department
Whitman County Commissioners
Whitman County Planning Department
Yakima County Commissioners
Yakima County Planning Department

Local

Seattle Water Department
City of Aberdeen, Department of Planning and Economic Development
City of Everett, Public Works Department
City of Forks, Economic Development Steering Committee
Port of Port Angeles

Tribal

Chehalis Tribe
Chinook Tribe
Cowlitz Tribe
Hoh Tribe
Jamestown S'Klallam Tribe
Lower Elwha S'Klallam Tribe

Tribal (cont.)

Lummi Nation
Makah Tribal Council
Marietta Band of Nooksack Indians
Muckleshoot Tribal Council
Nisqually Tribe
Nooksack Tribe
Northwest Indian Fisheries Commission
Point No Point Treaty Council
Port Gamble S'Klallam Tribe
Puyallup Tribe
Quileute Tribe
Quinault Nation
Samish Tribe
Sauk-Suiattle Tribe
Shoalwater Bay Tribal Council
Skagit Tribe
Skokomish Tribe
Snohomish Tribe
Stillaguamish Tribe
Swinomish Tribe
Suquamish Tribe
Squaxin Island Tribe
Tulalip Tribe
Upper Skagit Tribe
Yakama Tribe

Libraries

Aberdeen Timberland Library
Antioch University of Seattle Library
Battelle Seattle Research Center Library
Bellevue Community College Library
Bellingham Public Library
Brewster Public Library
Burlington Public Library
Camas Public Library
Cathlamet City Library
Central Washington University Library
Central Washington University, Horticulture/Forestry Library
Centralia Timberland Library
Chehalis Timberland Library
Chehalis Tribe Library
Chelan Public Library
Cheney Public Library
Chewelah Public Library
City University, Bellevue Library
Clark College Library
Clark County Law Library
Cle Elum Public Library
Columbia Basin College Library
Colville Confederated Tribes Library
Colville Public Library
Davenport Public Library
Dayton Public Library
Eastern Washington University Library
Edmonds Community College Library
Ellensburg Public Library
Elwha S'Klallam Tribe Library
Enumclaw Public Library
Ephrata Public Library
Everett Community College Library
Everett Public Library
Evergreen State College Library
Fairwood Library
Forks Memorial Library
Fort Vancouver Regional Library
Fort Vancouver Regional Library, White Salmon Branch
Fort Vancouver Regional Library, Battle Ground Branch
Fort Vancouver Regional Library, Stevenson Branch
Foster Wheeler Environmental Library
Gonzaga University, Crosby Library
Georgia Pacific, Bellingham Division Library
Goldendale Public Library
Government Research Assistance Library
Grand Coulee Public Library
Grandview Community Library
Grays Harbor College, John Spellman Library
Green River Community College, Holman Library
Harrington Public Library
Heritage College Library
Highline Community College Library
Hoh Tribe Library
Hoquiam Timberland Library
Issaquah Library
ITT Rayonier Research Center Library
James River Corporation, Camas Technical Center Library
Jamestown S'Klallam Tribal Library

Libraries (cont.)

Jefferson County Rural Library
John A. Brown Library
Kalispel Tribe Library
Kelso Public Library
Kettle Falls Public Library
King County Library
King County Library, North Bend Branch
Kitsap Regional Library
Kittitas Public Library
Lacey Timberland Library
Longview Public Library
Lower Columbia College,
Alan Thompson Library
Lummi Reservation Library
Makah Tribe Library
Mid Columbia Library
Mid Columbia Library,
West Richland Branch
Mt. Vernon Public Library
Muckleshoot Library
Montesano Timberland Library
Natural Resources Building Library
Neill Public Library
Nisqually Tribe Library
North Central Regional Library
North Central Regional Library,
Republic Branch
North Central Regional Library,
Waterville Branch
Nooksack Tribe Library
North Seattle Community College Library
Northwest Indian Fisheries Commission
North Olympic Library, Forks Branch
North Olympic Library, Port Angeles Branch
Okanogan Public Library
Olympia Timberland Library
Olympic College Library
Omak Public Library
Othello Public Library
Pasco Public Library
Pend Oreille County Library
Peninsula College, John D. Glenn Library
Pierce College, Fort Steilacoom Library
Pierce County Library
Pomeroy Library
Port Gamble S'Klallam Tribe Library
Port Townsend Public Library
Prosser Public Library
Pullman Public Library
Puyallup Public Library
Puyallup Tribe Library
Raymond Timberland Library
Quileute Tribe Library
Quinault Indian Nation Library
Reardan Memorial Library
Renton Public Library
Richland Public Library
Ritzville Public Library
Roslyn Public Library
St. Martins College Library
San Juan Island Library
Sauk-Suiattle Tribe Library
Seattle Central College Library
Seattle Community College Library
Seattle Pacific University Library
Seattle Public Library
Seattle University Library
Sedro Woolley Public Library
Shoalwater Bay Community Library
Shoreline Community College,
Ray W. Howard Library
Skagit Valley College Library
Skokomish Tribe Library
Sno Isle Regional Library
Sno Isle Regional Library, Coupeville
Branch
Sno Isle Regional Library, Langley Branch
Sno Isle Regional Library, Stanwood
Branch
South Bend Timberland Library
South Puget Sound Community College
Library
South Seattle Community College Library
Spokane Community College Library
Spokane County Library
Spokane Falls Community College Library
Spokane Public Library
Spokane Tribe Library
Sprague Public Library
Squaxin Island Tribal Library
Stillaguamish Tribe Library
Suquamish Tribe Library
Swinomish Tribe Library
Tacoma Community College Library
Tacoma Public Library
Tri Cities University Library
Tulalip Tribe Library

Libraries (cont.)

Tumwater Timberland Library
University of Puget Sound, Collins Memorial Library
University of Washington, Allen Library
University of Washington, College of Forest Resources Library
University of Washington Library, Government Publications
University of Washington, School of Fisheries Library
Upper Skagit Tribe Library
U.S. Environmental Protection Agency, Region 10 Library
Waitsburg Weller Public Library
Walla Walla Community College Library
Walla Walla County Library
Washington State Library
Washington State University, Environmental Science Library
Washington State University, Department of Forestry Library
Washington State University, Government Documents
Wenatchee Public Library
Wenatchee Valley College Library
Western Washington University, Huxley College Library
Western Washington University, Mabel Zoe Wilson Library
Weyerhaeuser Corporate Library
Weyerhaeuser Forestry Library
Weyerhaeuser Technical Center Library
Whatcom Community College Library
Whatcom County Library
Whitman College, Penrose Library
Whitman County Library
Whitworth College Library
Wilbur Public Library
William G. Reed Timberland Library
Winthrop Public Library
Yakama Indian Nation Cultural Center Library
Yakima Valley Community College Library
Yakima Valley Regional Library

Organizations

Audubon Society (state)
American Rivers
Beak Consultants
Black Hills Audubon Society
Boise Cascade
Bullitt Foundation
Buse Timber and Sales
Champion International
Columbia Gorge Audubon
Council of Presidents
Forest Land Management Commission
Foster Wheeler Environmental
Greater Ecosystem Alliance
Island Foresters
ITT Rayonier
Longview Fibre
Mantech Environmental
The Mountaineers
Murray Pacific
The Nature Conservancy
Northwest Forestry Association
Olympic Peninsula Foundation
Parametrix, Inc.
Pacific Lumber and Shipping
People for Puget Sound
Plum Creek
Pope & Talbot
Puget Sound Society for Conservation Biology
Resources Northwest, Inc.
Save Our Wild Salmon
Seattle Audubon
Sierra Club
Simpson Timber
Trout Unlimited
Washington Association of School Administrators
Washington Commercial Forest Action Committee
Washington Environmental Council
Washington Forest Protection Association
Washington Hardwoods Commission
Washington State Association of Counties

Organizations (cont.)

Washington State School Directors' Association
Washington Trout
Washington Wildlife Federation
Washington Wilderness Coalition
Western Ancient Forest Campaign
Western Forest Industries Association
Wild Salmon Center
The Wilderness Society
World Wildlife Fund
Wind River Logging Co.

Individuals

Katherine Baril
Bruce Barnum
Bob Benton
Colleen Berg
Alice Blandin
Cedar Blomberg
Jody Brower
Elsa Bruton
Lanny Carpenter
Tina Chan
Ellen Chu
John Clevenger, Jr.
Clifton Collins
Michael Collins
Lisa Dabek
Helen Daly
Jack Davis
Carolyn Dobbs
Harm Dotinga
Gene Dziedzic
Ronald Figlar Barnes
Jerry Franklin
Julie Garrison
Margaret Gaspari
Marcy Golde
Warren Groves
Tom Hamer
Janet Hardin
Kathleen Hedtke
Becky Herbig
Clayton Hobart
Richard Holthausen
James Karr
Jim Klinck
Joel Kuperberg
Kirk Lakey
Jeff Langlow
Darrell Linton
Mike Mackelwich
Jill Mackie
Larry Maechler
Joe Mennish
Charley Moyer
Grant Munro
Nancy Naslund
Dan Norkowski
Bill Null
Randall Payne
Bert Paul
Olemara Peters
Karen Peters Waldron
Charles Peterson
Alicia Pool
Martin Raphael
Ivan Redmund
Melanie Rowland
Robert Sager
Jim Schafer
Randy Scott
Jean Stam
Dave Stokes
Dan Stroh
Steve Tharinger
Ed Thiele
Sonjia Thompson
Linda Thomson
Neil and Milicent Turnberg
Brian Urbain
Aaron Viles
Paul Wagner
Roy Wagner
Jim Walton
Jeff White
Larry Williams
Shawna Wittman
Vim Wright
E Zahn
F R Zimmerman