Table of Contents for Appendix E

SILVICULTURAL CERTIFICATION FOR NFMA COMPLIANCE

CLOAK TIMBER SALE

The proposed commercial thinning treatment of stands 426-428, 437, 465-481, 494-520, 566-568, 571, and 577-580 have been field verified by a certified silviculturist.

Based on my analysis, stand diagnosis and design criteria for the commercial thinning treatment, I recommend the following findings of facts pursuant to NFMA be made in this project decision:

There is reasonable assurance that if prescriptions are implemented as I have prescribed:

a. Soil, slope or other watershed conditions will not be irreversibly damaged.

b. Fertilization will not lower water quality in the fertilized area or downstream.

I further find that:

All lands within this project area that would be harvested are suitable for timber production.

Evenaged management is the optimal appropriate silvicultural system and commercial thinning is the optimum harvest method for those stands prescribed for treatment because it meets the objectives of the *NORTHWEST FOREST PLAN*, the *MT HOOD FOREST PLAN* and the recommendations of the *UPPER CLACKAMAS, LOWER CLACKAMAS and OAK GROVE WATERSHED ANALYSES*. These stands have not reached culmination of mean annual increment for fiber production.

All units or combination of adjacent units and immediately adjacent existing plantations less than an average of 4.5 feet in height do not create openings greater than 60 acres in size.

/S/ *Glenda Goodwyne* March 30, 2004

Silviculturist Date

STAND DIAGNOSIS

CLOAK TIMBER SALE

EXISTING CONDITIONS

Forty-five of the fifty-six units for the proposed Cloak project area are made up of early seral stands that range from 30 to 43 years old. Three of the stands vary between 65 and 69 years. Another eight belong to the 81 to 95 age class.

Primary plant associations in the project area include the following:
ABAM/VAME/XETE (Pacific silver fir /Alaska huckleberry/beargrass),
TSHE/RHMA/VAAL-COCA (western hemlock/Pacific rhododendron/Alasaka huckleberry-bunchberry dogwood)
TSHE/RHMA-BENE (western hemlock/Pacific rhododendron/dwarf Oregon-grape)
TSHE/ACCI/ACTR (western hemlock/ vine maple/vanilla leaf)
TSHE/POMU (western hemlock/ sword fern)
TSHE/POMU/OXOR (western hemlock/sword fern/Oregon oxalis)
TSHE/BENE (western hemlock/dwarf Oregon-grape)
TSHE/VAAL/COCA (western hemlock/Alaska huckleberry/bunchberry dogwood)
TSHE/VAME/XETE (western hemlock/Alaska huckleberry/beargrass)
TSHE/RHMA-GASH (western hemlock/Pacific rhododendron-salal).

Douglas-fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*), Pacific silver fir (*Abies amabilis*) and noble fir (*Abies procera*) are the major conifer species found here, although some western redcedar, (*Thuja placata*) is present. The most common shrub and herb species comprise vine maple (*Acre circinatum*), Pacific rhododendron (*rhododendron macrophyllum*), beargrass (*Xerophyllum tenax*), Alaska huckleberry (*Vaccinium alaskaense*), bunchberry dogwood (*Cornus canadensis*) and dwarf Oregon-grape (*Berberis nervosa*).

Productivity for the Cloak area is variable and has been determined to range between Site Classes III and VI (*Douglas-fir, Upper Limits of Site Indices for Dominant Trees*, FSH June 1974) with the majority of the stands in Site Class III. These site classes were established by measuring the height of the most dominant trees in each unit and correlating this figure with their age. This data was obtained from stand examinations completed at each unit.

Elevations for the units range from about 1,700' to 4,400'. The aspect varies. No areas considered for treatment have been identified as unsuitable for timber management. Large logs (>24" diameter) that are in decay classes 4 and 5 can be found in few of the proposed units. Canopy closure is generally greater than 75%. Conifer canopy cover, in some places can be so dense that few plants are surviving in the understory.

TREATMENT OPTIONS

Proposed areas under consideration for treatment were field reviewed by a Certified Silviculturist and specific silvicultural systems were selected based upon site specific analysis, area management goals and objectives (Four 86, FW-315).

Treatment options considered in this analysis were: 1) No Treatment; 2) Regeneration harvest; and 3) Thinning.

The **no treatment option** was not chosen because it would not move any of the stands closer to the stated goal for Matrix lands (Four 289) or desired future condition, (Four-290) nor would it address active management of Matrix ground for optimizing return on present investments (Four-293, C1-031 and 033).

The **regeneration harvest option** was not chosen as the optimal treatment to achieve to achieve resource management goals. The *Mt. Hood National Forest Plan* states that timber stands should be considered for regeneration harvest when they have reached or surpassed 95% of culmination of mean annual increment (CMAI) measured in cubic feet (Four-86, FW-306). This is not the case with all but six of the second growth stands now under consideration (Four-86, FW-306).

The **commercial thinning option** was selected because it is most suitable for the stands under consideration for treatment at this time in order to meet desired future conditions (Four-290; Four-292, C1-024). All of the stands are presently overstocked and are need of density management. The younger stands, in particular, need thinning in order to maintain or increase their level of growth and health (Four-91, FW-372). Although six of the older stands have surpassed 95% CMAI, they have also been identified as part of the interim connectivity net. They would be commercially thinned in order to maintain their health and to help enhance their function as part of the interim connectivity net.

TREATMENT PROPOSAL

The action proposed by the Forest Service to meet the purpose and need of the Cloak EA is to commercially thin and harvest wood fiber from approximately 1,332 acres of Matrix land and approximately 217 acres of Riparian Reserves.

On areas proposed for Matrix thinning, the prescription would be adjusted on approximately 545 acres to increase forage for deer and elk. This would involve wider tree spacing and/or the inclusion of small forage enhancement areas of 1-3 acres on 10-15% of this acreage to get increased sunlight to the forest floor. A total of approximately 70 acres of scattered forage enhancement areas would be created. These areas would retain a range of 10-30 trees per acre following treatment. The lower range would be left in the smaller forage enhancement areas and the higher rate would apply to the larger areas.

The proposed action is to aerially apply 200 pounds of nitrogen per acre to approximately 1,081 acres of second growth conifer stands within the matrix.

The harvesting operation would generally remove the smaller trees. The average cut tree size would be approximately 10-12 inches in diameter. The estimated leave tree would range from 13-18 inches in diameter, depending upon the stand.

WINDTHROW

Evidence of trees being uprooted by the wind has been found in almost every forested region of the world. Winds can cause both uprooting of whole trees and snapping of stems and branches. Stem breakage tends to be more common in dense stands, where the stems are tall and slender, than in open-grown stands, where the stems are thicker and more tapered. Studies suggest that a stem diameter of less than 1 percent of total tree height is very unstable for most species. Thinning tends to enhance a tree's roots and stem to become more mechanically adapted to wind loads. When trees are grown at wide spacing they can develop resistance to wind by growing strong stems along with strong and spreading roots. Trees grown at tight spacing on the interior of stands are protected from the wind and will not develop the resistant stem or roots.

All but eleven of the stands proposed for thinning have been precommercially thinned in the past. As a result, they have strong stems and root systems at this time. Thinning will add to their continued stability in the wind. It is believed that windthrow will not be a significant problem in these stands.

All of remaining stands are natural in origin. In several of these stands, it can be seen that the tops have already broken out on many of the trees due to the high height-to-diameter ratio. While most of this has taken place in the intermediate layer, some tops have been lost in the co-dominant and dominant layers also. This indicates that more breakage can be expected to occur whether or not treatment takes place. However, it is anticipated that windthrow would occur at an acceptable level. About five years following thinning, it is expected that stability of the residual stands will increase as both their root systems and needle complement increase and diameter growth improves.

/s/ E. Craig Edberg. — March 30, 2004
Silviculturist — Date

RELATIVE DENSITY

Stand densities in the Cloak Timber Sale area were analyzed using Curtis' Relative Density method. Determination of the thinning level for these stands was based on the need to meet resource management objectives. The table below displays the approximate pre and post RDs for the proposed timber sale. All stands will be treated using a variable density thinning where relative density should average ± 15% of the post RD at any given point in the stand.

Cloak Std #s	Pre RD	Post RD	Cloak Std #s	Pre RD	Post RD
426	57	28	501	55	35
427	58	33	502	50	36
428	76	28	503	79	31
437	65	30	504	50	34
465	57	33	505	59	40
466	70	42	506	46	34
467	61	32	507	84	29
468	85	41	508	58	33
469	58	28	509	60	30
470	58	30	510	56	34
471	52	29	511	49	34
472	55	28	512	56	30
474	64	28	513	48	29
475	65	36	514	52	31
476	61	30	515	52	29
477	59	30	516	49	27
478	60	28	517	67	31
479	51	30	518	57	28
480	71	29	519	60	30
481	57	33	520	55	27
494	75	33	566	54	38
495	92	34	567	48	34
496	54	25	568	43	32
497	58	35	571	42	31
498	49	37	577	56	33
499	67	40	578	56	33
500	56	34	579	52	30
501	55	35	580	53	28

ANALYSIS OF OLDER FOREST

(From Page 32 of the Slinky EA)

Pine marten and pileated woodpecker habitat

	Oak Grove		Upper Clack	
Data source: Watershed Analysis and GIS data from Veg2000.shp	Acres	% of Watershed	Acres	% of Watershed
Vegetated Acres in Watershed.	87,367		100,380	
Amount of older forest at time of Watershed Analysis.	37,568	43%	38,144	38%
Current level of older forest.	37,147	42.5%	37,085	36.9%
Level of older forest after Slinky.	**36,991**	**42.3%**	**37,057**	**36.9%**
Minimum level of older forest specified in the Northwest Forest Plan.		15%		15%
Amount of interior older forest at time of Watershed Analysis.	10,484	12%	11,124	11%
Current level of interior older forest.	10,455	12%	11,119	11%
Level of interior older forest after Slinky.	**10,452**	**12%**	**11,119**	**11%**

DecAID Advisor

The following is a summary of snag data contained in the DecAID advisor for three different tolerance levels for both the Western Lowland Conifer Hardwood Forest Oregon Cascades and the Montane Mixed Conifer Forest. The data for each of these habitat types is given for three different structural conditions, which are basically similar to the three different seral conditions identified in the watershed analysis for both the Oak Grove and the Upper Clackamas.

DecAID – Snag Density and Sizes for 3 Different Tolerance Levels

"Western Lowland Conifer Hardwood Forest Oregon Cascades" vegetative condition best fits with the Western Hemlock And Pacific Silver fir Plant Series

Vegetative Conditions Western Lowland Conifer Hardwood Forest Oregon Cascades	80% Tolerance Level for Snag Density and Diameter	50% Tolerance Level for Snag Density and Diameter	30% Tolerance Level for Snag Density and Diameter l
Larger (Late Seral)	36.4/acre > 10 in. with more than 14/acre > 20 in.	18.6/acre > 10 in. with more than 8.1/acre > 20 in.	5.3/acre > 10 in. with more than 4.8/acre > 20 in.
Small/Medium (Mid Seral)	36.4/acre > 10 in. with more than 15/acre > 20 in.	18.6/acre > 10 in. with more than 8.1/acre > 20 in.	5.3/acre > 10 in. with more than 4.8/acre > 20 in.
Open Canopy (Early Seral)	26/acre > 10 in. with more than 12.5/acre > 20 in.	9.4/acre > 10 in. with more than 4.2/acre > 20 in.	5/acre > 10 in. with more than 2.1/acre > 20 in.

"Montane Mixed Conifer Forest" vegetative condition best fits with the Mountain Hemlock Plant Series

Vegetative Conditions Montane Mixed Conifer Forest	80% Tolerance Level for Snag Density and Diameter	50% Tolerance Level for Snag Density and Diameter	30% Tolerance Level for Snag Density and Diameter l
Larger (Late Seral)	27/acre > 10 in. with more than 15/acre > 20 in.	15/acre > 10 in. with more than 9/acre > 20 in.	11/acre > 10 in. with more than 6.5/acre > 20 in.
Small/Medium (Mid Seral)	32/acre > 10 in. with more than 9.5/acre > 20 in.	16.6/acre > 10 in. with more than 4.2/acre > 20 in.	10/acre > 10 in. with more than 2.7/acre > 20 in.
Open Canopy (Early Seral)	23/acre > 10 in. with more than 5.3/acre > 20 in.	8.5/acre > 10 in. with more than 2.1/acre > 20 in.	4/acre > 10 in. with more than 1.1/acre > 20 in.

The following tables contain a summary of the snag data provided in the watershed analyses. The data in the watershed analysis is summarized in a slightly different manner than the information in the DecAID advisor. The watershed analysis separates snags into large (> 21 inches) and small (15 to 21 inches). The DecAID advisor generally uses large (>20 inches) and small (10 to 20 inches). In terms of comparison, the watershed analysis under estimates the amount of snags.

The following analysis compares the snag data from the watershed analysis to the tolerance levels for the different wildlife habitat types and structural conditions identified in the DecAID advisory tool. It displays the percentage of the watershed in each structural condition and the tolerance level for snags. The percentages are based on all past, present and foreseeable future actions. Since the Watershed Analyses were completed, approximately 577 acres within the Oak Grove and 1087 acres within the Upper Clackamas 5th field watersheds have been or would be converted from late-seral snag habitat to early-seral snag habitat.

Average Snag Levels and Tolerance levels for Unmanaged and Managed Stands* within the Upper Clackamas 5th Field Watershed

Plant Series and Seral Stage	Large Snags per acre > 21 in.	Small Snags per acre 15 to 21 in.	Current Tolerance Level at the Landscape Scale	Percent of Watershed
Western Hemlock Late Seral	6.2	1.7	> 30%	13.1%
Western Hemlock Mid Seral	0.1	13.5	> 30% but lacks large snags	1.8%
Pacific Silver Late Seral	7.8	4.8	Between 30% and 50%	22.8%
Pacific Silver Mid Seral	1.9	3.2	Less than 30%	11.1%
Mountain Hemlock Late Seral	3	0.1	Less than 30%	3.9%
Mountain Hemlock Mid Seral	0.9	0.7	Less than 30%	11.8%
All Series, Early Seral Plantations	1.5	0.5	Less than 30%	18.1%
All Series, Mid Seral Plantations	0.1	0.1	Less than 30%	14.6%

Average Snag Levels and Tolerance levels for Unmanaged and Managed Stands within the Oak Grove 5th Field Watershed

Series and Seral Stage	Large Snags > 21 in.	Small Snags 15 to 21 in.	Current Tolerance Level at the Landscape Scale	Percent of Watershed
Western Hemlock Late Seral	4	2.1	Close to 30%	9.9%
Western Hemlock Mid Seral	2	2.4	Less than 30%	1.9%
Pacific Silver Late Seral	6.4	6.1	Between 30% and 50%	27.9%
Pacific Silver Mid Seral	2.9	5.0	Close to 30%	11.8%
Mountain Hemlock Late Seral	1.8	0.2	Less than 30%	4.8%
Mountain Hemlock Mid Seral	0.9	1.9	Less than 30%	2.6%
All Series, Early Seral Plantations	1.8	0.5	Less than 30%	21.4%
All Series, Mid Seral Plantations	0.1	0.1	Less than 30%	15.5%

Average Snag Levels and Tolerance levels for Unmanaged and Managed Stands within the Lower Clackamas 5th Field Watershed

Plant Series and Seral Stage	Large Snags per acre > 21 in.	Small Snags per acre 15 to 21 in.	Current Tolerance Level at the Landscape Scale	Percent of Watershed
Western Hemlock Late Seral	6.2	1.7	> 30%	31.9%
Western Hemlock Mid Seral	0.1	13.5	> 30% but lacks large snags	11.6%
Pacific Silver Late Seral	7.8	4.8	Between 30% and 50%	15.2%
Pacific Silver Mid Seral	1.9	3.2	Less than 30%	3.0%
Mountain Hemlock Late Seral	3	0.1	Less than 30%	1.5%
Mountain Hemlock Mid Seral	0.9	0.7	Less than 30%	1.7%
All Series, Early Seral Plantations	1.5	0.5	Less than 30%	8.4%
All Series, Mid Seral Plantations	0.1	0.1	Less than 30%	21.4%

AQUATIC CONSERVATION STRATEGY

The Record of Decision to Clarify Provisions Relating to the Aquatic Conservation Strategy (USDA USDI, 2004a) contains new guidance on how to implement the Aquatic Conservation Strategy. Some highlights of the clarification include: (1) Project plans are not required to assess the contribution of a site-specific project to achieving Aquatic Conservation Strategy objectives. (2) The Aquatic Conservation Strategy objectives are not to be interpreted as standards and guidelines applicable to individual projects. (3) Project would be designed to contribute to maintaining or restoring the fifth-field watershed over the long term, even if short-term effects may be adverse.

1. **The existing condition, including the important physical and biological components of the fifth-field watersheds.** *The existing conditions for local resources can be found in the EA in the Water Quality and Fish section and in the Wildlife section. The existing conditions for fifth-field watersheds can be found below in this Appendix.*

2. **The effect of the project on the existing condition.** *The effects of the alternatives on resources can be found in the EA in the Water Quality and Fish section and in the Wildlife section.*

3. **Relevant information from applicable watershed analysis used in designing and assessing the project.** The project overlaps three Watershed Analyses.

Page references	Oak Grove	Upper Clackamas	Lower Clackamas
Emphasis on thinning opportunities	Table 10-1	52, 61, 77	6-13
Riparian reserve widths	130	65	6-3
Stream surveys	89	28	2-40

4. **Consistency with Riparian Reserve standards and guidelines of the NFP on pages C-31 to C-38.** (Where standards and guidelines contain direction to "meet," "not adversely affect," "not retard or prevent attainment of" or otherwise "achieve ACS objectives," the Aquatic Conservation Strategy objectives apply only at fifth-field watershed and larger scales, are achieved only over a period of decades or longer, and do not provide additional direction constraining the short-term or long-term effects of individual projects."

Applicable riparian reserve standards and guidelines:

TM-1 c. Apply silvicultural practices for riparian Reserves to control stocking, reestablish and manage stands, and acquire desired vegetation characteristics needed to attain ACS objectives. *Refer to the purpose and need section. The objective of thinning in riparian reserves is to accelerate the development of mature and late-successional stand conditions. The design criteria and best management practices provide protection to riparian and aquatic resources.*

RF-2. For each existing or planned road, meet Aquatic Conservation Strategy objectives by:

a. minimizing road and landing locations in Riparian Reserves.
b. completing watershed analyses (including appropriate geotechnical analyses) prior to construction of new roads or landings in Riparian Reserves.
c. preparing road design criteria, elements, and standards that govern construction and reconstruction.
d. preparing operation and maintenance criteria that govern road operation, maintenance, and management.
e. minimizing disruption of natural hydrologic flow paths, including diversion of streamflow and interception of surface and subsurface flow.
f. restricting sidecasting as necessary to prevent the introduction of sediment to streams.
g. avoiding wetlands entirely when constructing new roads.
   The proposed temporary roads are not located within riparian reserves and they would be built on gentle landforms and obliterated upon project completion. They would be consistent with this standard and guideline.

RF-3. Determine the influence of each road on the Aquatic Conservation Strategy objectives through watershed analysis. Meet Aquatic Conservation Strategy objectives by:

a. reconstructing roads and associated drainage features that pose a substantial risk.
b. prioritizing reconstruction based on current and potential impact to riparian resources and the ecological value of the riparian resources affected.
c. closing and stabilizing, or obliterating and stabilizing roads based on the ongoing and potential effects to Aquatic Conservation Strategy objectives and considering short-term and long-term transportation needs.
   Road reconstruction needs have been identified along haul routes.

RF-5. Minimize sediment delivery to streams from roads. Outsloping of the roadway surface is preferred, except in cases where outsloping would increase sediment delivery to streams or where outsloping is unfeasible or unsafe. Route road drainage away from potentially unstable channels, fills, and hillslopes.
The proposed temporary roads are not located within riparian reserves and they would be built on gentle landforms and obliterated upon project completion. They would be consistent with this standard and guideline.

Fifth-field Watersheds
Summaries of Existing Condition

Upper Clackamas River

The Upper Clackamas fifth field watershed includes the headwaters of the mainstem Clackamas River and all its tributaries downstream to the confluence of the Collawash River. The watershed comprises 100,380 acres on the west slope of the Cascade Range. Approximately 94,800 acres of the watershed is within the Mt. Hood National Forest. About 5,600 acres lie within the Confederated Tribes of the Warm Springs Reservation of Oregon, and approximately 150 acres at Austin Hot Springs are privately owned.

The river corridor of the Upper Clackamas River watershed is designated as a Tier 1 key watershed in the Northwest Forest Plan. Tier 1 watersheds have been identified as crucial refugia for at-risk fish species. The Clackamas River is also designated as a Scenic and Recreational River under the National Wild and Scenic Rivers Act and a State Scenic Waterway. The Wild and Scenic Management Plan describes the outstandingly remarkable values of fish, botany, wildlife, recreation, and cultural resources associated with the Clackamas River.

The upper Clackamas River supports populations of federally and state listed fish species that includes winter steelhead, spring chinook salmon, and coho salmon. The late-run coho salmon in the Clackamas is believed to be the last remaining stock of wild lower Columbia River coho salmon. Native late-run coho, spring chinook, and winter steelhead have declined in the latter half of the twentieth century.

Management activities that have had an effect on aquatic resources in the Clackamas River include timber harvest, road building, hatchery introductions, and hydroelectric development. Since timber harvesting began in the watershed in the late 1940's, approximately 29,000 acres have been harvested. The Riparian Reserves along the mainstem and most of the larger tributaries have remained largely intact with the exception of the Road 46 right-of-way. Currently, 24% of the Riparian Reserve area within the watershed is in early-seral forest condition.

There are approximately 428 miles of roads in the watershed, which equates to a road density of 2.9 miles of road per square mile. The increase in drainage network due to the construction of roads in the watershed is less than nine percent.

Using the "Matrix of Pathways and Indicators" (NOAA Fisheries, 1996), the condition of the existing environmental baseline with in the Upper Clackamas River watershed was assessed. Baseline habitat indicators that are described "at risk" in the Upper Clackamas watershed include: physical barriers, large woody debris, off-channel habitat, width to depth ratio, streambank condition, floodplain connectivity, increase in drainage network, road density, and riparian reserves. Temperature, sediment and turbidity, chemical contaminants/nutrients, substrate/sediment, pool quality, and refugia are described as

"properly functioning." Pool frequency within the watershed is described as "not properly functioning."

Restoration projects implemented within the Upper Clackamas watershed have focused on improving fish passage, decreasing road densities, and restoring off-channel habitat and floodplain connectivity.

The upper Clackamas River is a resilient watershed due to its spring-supported hydrology. Watershed analysis did not discern changes in hydrology of the watershed. The current condition of the landscape does not reflect altered hydrologic regimes. Due to an increase in road density and expansion of the stream network from roads, one would expect an increase in peak flows for the lower return interval storm events. Evidence of increased peak flows is not apparent in the channel.

The existing quantity and quality of fish habitat in the Upper Clackamas Watershed does not appear to limit anadromous fish production as much as other factors. Commercial and recreational fishing and hydroelectric facilities affect the escapement of anadromous fish to the watershed more so than fish habitat.

Oak Grove Fork

The Oak Grove Fork of the Clackamas River is a fifth-order tributary to the Clackamas River originating from rainwater and snowmelt on the western slopes of the high cascades. The Oak Grove Fork fifth-field watershed comprises approximately 91,000 acres and includes the headwaters of the Oak Grove Fork and all of its tributaries downstream to the confluence with the mainstem Clackamas River at RM 53.0. The Mt. Hood National Forest and the Confederated Tribes of the Warm Springs are the primary land managers. The Oak Grove Fork contributes less than 10 percent of the flow in the Clackamas River due to the complete diversion of the river at Harriet Dam (RM 4.8) during all but peak flow periods. The diverted flows are used to generate power at the Oak Grove Powerhouse located along the mainstem Clackamas River. The only flow within the Oak Grove Fork below Lake Harriet Dam is accretion flow from springs and tributaries.

The river corridor of the Oak Grove Fork watershed up to RM 3.8 is designated as a Tier 1 key watershed in the Northwest Forest Plan. Tier 1 watersheds have been identified as crucial refugia for at-risk fish species. A falls located at RM 3.8 is a complete barrier to anadromous passage.

The Oak Grove Fork supports populations of federally and state listed fish species that includes winter steelhead, spring chinook salmon, and coho salmon. The late-run coho salmon that occurs within the Clackamas River and Oak Grove Fork is believed to be the last remaining stock of wild lower Columbia River coho salmon.

Management activities that have had an effect on aquatic resources in the Oak Grove Fork include timber harvest, road building, hatchery introductions, and hydroelectric

development. As stated above, hydroelectric development diverts the entire flow of the upper Oak Grove Fork to generate electricity. The Riparian Reserves along the mainstem Oak Grove Fork have remained largely intact. Currently 5,035 acres or 26% of the riparian reserve within the watershed is in early-seral forest condition.

The Oak Grove Fork is a managed watershed. There are approximately 402 miles of roads in the watershed, which equates to a road density of 3.2 miles of road per square mile. Road densities range from 3.3 miles/square mile to 5.03miles/square mile in the subwatersheds. Clearcut timber harvest in the past has created many openings, and the watershed is hydrologically recovering from those effects. Analysis shows influences from earlier clearcut harvest is reducing, and peak flow modeling through the Aggregate Recovery percentage model is within ranges recommended in the Mt. Hood Forest Plan.

Using the "Matrix of Pathways and Indicators" (NOAA Fisheries, 1996), the condition of the existing environmental baseline with in the Oak Grove Fork watershed was assessed. Baseline habitat indicators that are described "at risk" in the Oak Grove watershed includes: large woody debris, floodplain connectivity, off-channel habitat, refugia, and riparian reserves. Temperature, chemical contaminants and nutrients, physical barriers, substrate, pool quality, pool frequency, and streambank condition are described as "properly functioning". Not properly function indicators within the Oak Grove watershed includes: sediment, width/depth ratios, changes in peak flows, increase in drainage network, and road density and location.

Restoration projects implemented within the Oak Grove watershed have focused on improving instream habitat complexity, decreasing road densities, and restoring off-channel habitat and floodplain connectivity.

Lower Clackamas River

The Lower Clackamas Watershed includes the mainstem Clackamas River and all of the smaller watersheds that drain into the Clackamas from the Mt. Hood National Forest boundary to the confluence of the Collawash River. The watershed is 43,250 acres in size. Approximately 40,387 acres lie within the Forest Service land, 994 acres are within Lands administered by the U.S. Bureau of Land Management, and 1,870 acres are privately owned.

The river corridor of the Lower Clackamas River watershed is designated as a Tier 1 key watershed in the Northwest Forest Plan. Tier 1 watersheds have been identified as crucial refugia for at-risk fish species. The Clackamas River is also designated as a Scenic and Recreational River under the National Wild and Scenic Rivers Act and a State Scenic Waterway. The Wild and Scenic Management Plan describes the outstandingly remarkable values of fish, botany, wildlife, recreation, and cultural resources associated with the Clackamas River.

The Clackamas River supports populations of federally and state listed fish species that includes winter steelhead, spring chinook salmon, and coho salmon. The late-run coho

salmon in the Clackamas is believed to be the last remaining stock of wild lower Columbia River coho salmon. Native late-run coho, spring chinook, and winter steelhead have declined in the latter half of the twentieth century. There are approximately 302 miles of streams that flow within the Lower Clackamas watershed. Anadromous fish populations occur within 33 miles of stream.

Management activities that have had an effect on aquatic resources in the Clackamas River include timber harvest, road building, hatchery introductions, and hydroelectric development. The riparian reserves of the watershed have been altered by past timber harvest. The total area of riparian reserves within the watershed is 15,464 acres. Of these riparian reserve acres, 3,326 acres (22%) are early seral stage. Most riparian reserve areas in this watershed now support second growth trees.

The Lower Clackamas River Watershed has 182 miles of roads, which equates to a road density of 2.85 miles per square mile. Most of the roads are not valley bottom roads, but there are 10.2 miles of road within 200 feet of perennial streams with numerous stream crossings throughout the watershed. There are 412 stream crossings (6.4 stream crossings per square mile of road) within the Lower Clackamas River watershed. The miles of road, number of stream crossings and dispersed campgrounds within the watershed has led to an increase in drainage network density.

Using the "Matrix of Pathways and Indicators" (NOAA Fisheries, 1996), the condition of the existing environmental baseline with in the Lower Clackamas River watershed was assessed. Baseline habitat indicators that are described "at risk" in the Lower Clackamas include: temperature, physical barriers, large woody debris, off-channel habitat, refugia, floodplain connectivity, road density, and riparian reserves. Sediment and turbidity, chemical contaminants/nutrients, substrate, pool quality, streambank condition, and peak/baseflows are described as "properly functioning." Pool frequency and drainage network increase within the watershed is described as "not properly functioning."

Restoration projects implemented within the Lower Clackamas watershed have focused on improving fish passage and decreasing road densities.

The above watershed summaries contain references to the Matrix of Pathways and Indicators. The description of existing conditions categorized in the Matrix of Pathways and Indicators (MPI) is relative to baseline conditions that would be expected under unmanaged conditions. The existing status (Properly Functioning, At Risk, or Not Properly Functioning) represents the condition today, and thus provides a baseline context for evaluating the effect of changes that would result under the various Alternatives.

The MPI generally categorizes Properly Functioning conditions for watershed processes as "similar" to unmanaged conditions, At Risk conditions as having "some alteration" or "minor differences" as compared to unmanaged conditions, and Not Properly Functioning conditions as "substantially different" or exhibiting "pronounced differences" relative to unmanaged conditions.

CLOAK THINNING PROJECT

KEY BEST MANAGEMENT PRACTICES FOR THE PROTECTION OF WATER QUALITY

This document summarizes the key Best Management Practices (BMPs) for the protection of water quality that will be used to minimize the potential for adverse effects to water quality, fish habitat, and site productivity during implementation of the Cloak Thinning Project. The full text of the general BMPs, and a more detailed explanation of the BMP implementation process, is contained in the document: General Best Management Practices for the Mt. Hood National Forest (August 2004). This BMP document is designed to implement the direction in the Mt. Hood Forest Plan standards and guidelines FW-055 through FW-059, and Appendix H, Best Management Practices.

Best Management Practices are defined as methods, measures or practices selected by an agency to meet its non-point source control needs. BMPs include, but are not limited to structural and nonstructural controls and operation and maintenance procedures. BMPs can be applied before, during and after pollution-producing activities to reduce or eliminate the introduction of pollutants into receiving waters (40 CFR 130.2, EPA Water Quality Standards Regulation). Best Management Practices are the primary mechanism to enable the achievement of water quality standards (U.S. Environmental Protection Agency, 1987). Some BMPs may not be applicable to all alternatives, for example road construction BMPs would not apply to alternatives that do not build roads. BMP training is ongoing for individuals involved in project design, layout, administration, and maintenance activities.

Cloak Thinning Project activities will be included in the Forest-wide pool of potential projects available for BMP monitoring. Each year a selected number of sites/units are selected at random from the Forest-wide pool of available projects for BMP monitoring. Activity sites are available for monitoring after they have gone through at least one winter following completion of the project activity.

The BMPs that apply to each location where various resource management activities are proposed are shown in the table below. A unit-by-unit listing of the type of harvesting system (helicopter, skyline, ground-based) for each unit is shown in tables located in the Cloak Thinning EA.

KEY BMPs APPLICABLE TO ALL SITES WHERE ACTIVITIES OCCUR IN THE CLOAK THINNING PROJECT AREA

Activity Type	**BMP Identifier**
Timber Harvesting	W-4, W-5
Ground-based harvesting	All Timber BMPs except BMP T-12.
Helicopter yarding	All Timber BMPs except BMP T-11.
Cable yarding	All Timber BMPs except BMP T-11
Landings	BMP T-3, T-4, T-5, T-6, T-7, T-8, T-10, T-13, T-14, T-15, T-19, T-21
Roads	W-4, W-5
Road maintenance	BMP R-12, R-15, R-16, R-18, R-19, R-20

Activity Type	BMP Identifier
Road decommissioning	BMP R-2, R-3, R-4, R-5, R-6, R-9, R-15, R-20, R-23
Road reconstruction	BMP R-2, R-3, R-4, R-5, R-6, R-7, R-9, R-12, R-15, R-16, R-20
Temporary road construction	All Road BMPs, except, BMP R-16, R-17, R-21
Timber haul	BMP R-19, R-20, R-21
Watershed Management	BMP W-1, W-4, W-5
Fuels Management	BMP F-1

BMP EFFECTIVENESS

Each BMP described below provides a qualitative assessment of expected effectiveness that the applied measure will have on preventing or reducing impacts on water quality. The effectiveness of each BMP will be evaluated with two indices, 1) ability to implement, and 2) effectiveness as indicated by administrative studies and professional judgment. For each index, the BMPs will be rated either high, moderate or low in effectiveness of preventing or reducing impacts.

- Ability to Implement

High: Greater than 90% certainty the BMP can be implemented as planned.

Moderate: Greater than 75%, but less than 90% certainty the BMP can be implemented as planned.

Low: Less than 75% certainty the BMP can be implemented as planned.

- Effectiveness

High: Practice is highly effective (> 90%) and one or more of the following types of documentation are available:
a. Administrative studies (AS) - local or within similar ecosystem.
b. Experience (EXP) - judgment of an expert by education and/or experience.
c. Fact (FCT)- obvious by reasoned (logical) response.
d. Scientific literature/research (LIT/RES) may also be available to document the effectiveness of many of the BMPs.

Moderate: Documentation (as described for high) shows that the practice is effective less than 90% of the time, but at least 75% of the time.

Or

Logic (LGC) indicates that this practice is highly effective, but there is no documentation to support the rating. Implementation and effectiveness of this practice will be monitored and the practice will be modified if necessary to achieve the objective of the BMP.

Low: Effectiveness unknown or unverified, and there is little or no documentation.

Or

Applied logic is uncertain in this case, or the practice is estimated to be less than 60% effective. This practice is speculative and needs both effectiveness and validation monitoring.

BEST MANAGEMENT PRACTICES ADMINISTRATIVE MONITORING STUDIES

Administrative BMP Monitoring Studies, Mt. Hood National Forest: Monitoring for BMP implementation and effectiveness was performed on a wide variety of BMPs, ranging from riparian reserve protection to temporary road construction. Monitoring results are summarized in the Forest Plan Monitoring and Evaluation Reports for Fiscal Years 1997 through 2002. The reports will be cited below, where applicable, in the BMP narratives for effectiveness using the abbreviation found at the end of each citation, for example, **MTH-AS-97** is the Forest Plan Monitoring and Evaluation Report for FY 1997, while **MTH-AS-02** is the same report for Fiscal Year 2002. BMP monitoring done during this period indicates that overall the BMPs monitored were prescribed and implemented as planned, resulting in adequate soil and water protection in most instances.

Other monitoring has occurred. One example is the Best Management Practices Evaluation Program (BMPEP), 1992-2002 Monitoring Results. USDA Forest Service, Pacific Southwest Region, Pacific Southwest Region. This report will be cited below, where applicable, as an indicator of BMP effectiveness in the narratives using the abbreviation, **BMPEP-R-5**.

ACRONYMS AND ABBREVIATIONS
EXP- Professional experience
NFP- Northwest Forest Plan
TSC- Timber Sale Contract
TSPP-Timber Sale Planning Process

DESCRIPTION OF BMPs

TIMBER MANAGEMENT BMPs

T-1. Title: Timber Sale Planning Process (TSPP)

Objective: To incorporate water quality and hydrologic considerations into the TSPP.

Explanation: *For the Cloak Thinning Project, a description of the affected environment and the potential environmental and cumulative effects to water quality is documented in the Cloak Thinning EA.*

Ability to implement: High

Effectiveness: High (EXP)

T-2. Title: Timber Harvest Unit Design

Objective: To ensure that timber harvest unit design will secure favorable conditions of water quality and quantity, while maintaining desirable stream channel characteristics and watershed conditions for the various beneficial uses of water such as fish habitat.

Explanation*: Harvest units were designed by an interdisciplinary team that included individuals with fisheries, soils and hydrology expertise.*

Ability to implement: High

Effectiveness: High (EXP)

T-3. Title: Determination of Surface Erosion Hazard for Timber Harvest Unit Design

Objective: To identify high erosion hazard areas in order to prevent downstream water quality degradation and loss of site productivity.

Explanation*: Surface soil erosion hazard for the Cloak Thinning Project harvest units was determined for each harvest unit and used for project design and the identification of appropriate design criteria.*

Ability to implement: High

Effectiveness: Moderate (EXP)

T-4. Title: Use of Sale Area/Project Maps for Designating Water Quality Protection Needs

Objective: To ensure recognition and protection of areas related to water quality protection are delineated on a Sale Area Map or Project Map.

Explanation*: A sale area map will be included in timber sale contracts that shows streams and other important features.*

Ability to implement: High

Effectiveness: High (EXP)

T-5. Title: Limiting the Operating Period of Timber Sale Activities

Objective: To ensure that the Purchaser conducts their operations, including erosion control work, road maintenance, and so forth in a timely manner, within the time period specified in the Timber Sale Contract (TSC).

Explanation: *Design Criteria #2.*

Ability to implement: High

Effectiveness: High (EXP)

T-6. Title: Protection of Unstable Lands

Objective: To provide for identification and appropriate management prescriptions for unstable lands.

Explanation: *Cloak Thinning Project activities have been designed to meet Mt. Hood Forest Plan standards and guideline pertaining to active landslides. Watershed specialists will assist in field layout of harvest units, where necessary, to ensure these standards and guidelines are implemented on the ground. For the Cloak Thinning Project, as necessary, physical scientists will assist sale layout crews during layout of proposed thinning units on unstable/earthflow terrain.*

Ability to implement: High

Effectiveness: Moderate (EXP)

T-7. Title: Riparian Reserve Designation

Objective: To designate a zone along permanently flowing streams, intermittent streams, lakes, and wetlands that will minimize potential for adverse effects to water quality and riparian values from adjacent management activities. Any management activities occurring within these zones should be designed for the purpose of either maintaining or improving riparian values.

Explanation: *Design Criteria #9 and 13.*

Ability to implement: High

Effectiveness: High (EXP, MTH-AS-98 through MTH-AS-02)

T-8. Title: Stream course and Aquatic Protection

Objective: (1) To conduct management actions within these areas in a manner that maintains or improves riparian and aquatic values. (2) To provide unobstructed passage of storm flows (3) to control sediment and prevent other pollutants from entering stream courses. (4) To restore the natural course of any stream as soon as practicable, where diversion of the stream has resulted from timber management activities.

Explanation*: Design Criteria #9 and 13. Standard and Special Provisions of the Timber Sale Contract.*

Ability to implement: High

Effectiveness: High (EXP, MTH-AS-00, MTH-AS-01)

T-9. Title: Determining Tractor Loggable Ground

Objective: To minimize erosion and sedimentation resulting from ground disturbance of tractor logging systems.

Explanation: *Design Criteria #10. Implementation and responsibility: Land suitable for tractor logging is described in the environmental assessment. Where necessary, and in consultation with resource specialists, any needed modifications are made during the sale layout phase of the TSPP. Requirements governing tractor operations are incorporated in the TSC.*

Monitoring: The Contracting Officer and Sale Administrator oversee the operation to insure compliance with the provisions of the TSC.

Ability to implement: High

Effectiveness: High (EXP)

T-10. Title: Log Landing Location

Objective. To locate landings or reuse old landings in such a way as to avoid watershed impacts and associated water quality degradation.

Explanation: *Design Criteria #11.*

Ability to implement: High

Effectiveness: High (EXP, BMPEP-R-5, MTH-AS-98 thru MTH-AS-01)

T-11. Title: Tractor Skid Trail Location and Design

Objective: By designing skidding patterns to best fit the terrain, the volume, velocity, concentration, and direction of runoff water can be controlled in a manner that will minimize erosion and sedimentation.

Explanation: *Design Criteria #10. Standard and Special Provisions of the Timber Sale Contract.*

Ability to implement: High

Effectiveness: High (EXP, BMPEP-R-5, MTH-AS-98 thru MTH-AS-02)

T-12. Title: Suspended Log Yarding In Timber Harvesting

Objective: To protect soils from excessive disturbance, to maintain the integrity of Riparian Reserves and other sensitive watershed areas and to control erosion on cable corridors.

Explanation: Design Criteria #8. *Skyline yarding would achieve one end suspension except during lateral yarding. All skyline corridors would be rehabilitated before winter season closure, where necessary. Rehabilitation will consist of one or more of the*

following: waterbarring, scattering slash, mulching, and/or seeding. Standard and Special Provisions of the Timber Sale Contract.

Ability to implement: High

Effectiveness: High (EXP, MTH-AS-98 through MTH-AS-00, BMPEP-R-5)

T-13. Title: Erosion Prevention and Control Measures During Timber Sale Operations

Objective: To ensure that the Purchaser's operations shall be conducted to minimize soil erosion.

Explanation*: Design Criteria #8. Standard and Special Provisions of the Timber Sale Contract.*

Ability to implement: High

Effectiveness: Moderate (Exp, BMPEP-R-5)

T-14. Title: Re-vegetation of Areas Disturbed by Harvest Activities

Objective: To establish a vegetative cover on disturbed sites to prevent erosion and sedimentation.

Explanation: *Design Criteria #8.*

Ability to implement: High

Effectiveness: Moderate (EXP, BMPEP-R-5)

T-15. Title: Log Landing Erosion Prevention and Control

Objective. To reduce the impacts of erosion and subsequent sedimentation associated with log landings by use of design criteria.

Explanation*: Design Criteria #8. Standard and Special Provisions of the Timber Sale Contract.*

Ability to implement: High

Effectiveness: High (BMPEP-R-5, MTH-AS-98 through MTH-AS-02)

T-16. Title: Erosion Control on Skid Trails

Objective: To protect water quality by minimizing erosion and sedimentation derived from skid trails.

Explanation: *For the Cloak Thinning Project, The Sale Administration Handbook section on Skid Trails and Fire lines guidelines will be used to determine the appropriate spacing*

of water bars, with closer waterbar spacing for steeper slopes. Water bar spacing may also be adjusted based on site-specific characteristics. Standard and Special Provisions of the Timber Sale Contract.

Ability to implement: High

Effectiveness: High (EXP,BMPEP-R-5, MTH-AS-98 through MTH-AS-02)

T-19. Title: Acceptance of Timber Sale Erosion Control Measures Before Sale Closure

Objective: To assure the adequacy of required erosion control work on timber sales.

Explanation*: Standard and Special Provisions of the Timber Sale Contract.*

Ability to implement: High

Effectiveness: High (EXP, BMPEP-R-5)

T-21. Title: Servicing and Refueling of Equipment

Objective: To prevent pollutants such as fuels, lubricants, bitumens, raw sewage, wash water and other harmful materials from being discharged into or near rivers, streams and impoundments or into natural or man-made channels.

Explanation*: Standard and Special Provisions of the Timber Sale Contract.*

Ability to implement: High

Effectiveness: High (EXP)

T-22. Title: Modification of the Timber Sale Contract (TSC)

Objective: To modify the TSC if new circumstances or conditions arise and indicate that the timber sale will damage soil, water or watershed values.

Explanation*: Standard and Special Provisions of the Timber Sale Contract.*

Ability to implement: High

Effectiveness: High (EXP, BMPEP-R-5)

T-23. Slash Treatment in Sensitive Areas

Objective: To maintain or improve water quality by protecting sensitive areas from degradation, which would likely result from using mechanized equipment for slash disposal.

Explanation: *In the Cloak Thinning Project area, logging slash from thinning operations would primarily be left in the units. Any slash that ends up at the landing would be piled*

and burned. No mechanical equipment will be used to pile slash within harvest units.

Ability to implement: High

Effectiveness: Moderate (EXP, BMPEP-R-5)

ROAD SYSTEM BMPs

R-1. Title: General Guidelines for the Location and Design of Roads

Objective: To locate and design roads with minimal resource damage.

Explanation: Design Criteria #11. *No new permanent system roads will be constructed in Cloak Thinning Project area.*

Ability to implement: High

Effectiveness: High (EXP)

R-2. Title: Erosion Control Plan

Objective: To limit erosion and sedimentation through effective planning prior to initiation of road construction activities and through effective contract administration during construction.

Explanation*: Standard and Special Provisions of the Timber Sale Contract.*

Ability to implement: High

Effectiveness: High (EXP, BMPEP-R-5)

R-3. Title: Timing of Construction Activities

Objective: To minimize erosion by conducting road construction operations during minimal runoff periods.

Explanation: Design Criteria #2.

Ability to implement: High

Effectiveness: High (EXP)

R-4. Title: Stabilization of Road Slope Surfaces and Spoil Disposal Areas

Objective: To minimize erosion from exposed cut slopes, fill slopes, and spoil disposal areas.

Explanation*: Standard and Special Provisions of the Timber Sale Contract.*

Ability to implement: High

Effectiveness: High (EXP, BMPEP-R-5)

R-5. Title: Road Slope Stabilization Construction Practices

Objective: To reduce sedimentation by minimizing erosion from road slopes and slope failures along roads.

Explanation*: Standard and Special Provisions of the Timber Sale Contract.*

Ability to implement: High

Effectiveness: High (EXP, BMPEP-R-5)

R-6. Title: Dispersion of Subsurface Drainage From Cut and Fill Slopes

Objective: To minimize the possibilities of cut or fill slope failure and the subsequent production of sediment.

Explanation*: Standard and Special Provisions of the Timber Sale Contract.*

Ability to implement: High

Effectiveness: High (EXP)

R-7. Title: Control of Road Drainage

Objective: To minimize the erosive effects of water concentrated by road drainage features, to disperse runoff from disturbances within the road clearing limits, to lessen the sediment generated from roaded areas and to minimize erosion of the road prism by runoff from road surfaces and from uphill areas.

Explanation: *Temporary roads in the Cloak Thinning Project areas will be constructed with rolling dips where necessary to disperse surface runoff.*

Ability to implement: High

Effectiveness: High (EXP, BMPEP-R-5)

R-9. Title: Timely Erosion Control Measures on Incomplete Roads and Stream Crossing Projects

Objective: To minimize erosion and sedimentation from disturbed ground on incomplete projects.

Explanation*: No roads would be constructed across streams. Standard and Special Provisions of the Timber Sale Contract.*

Ability to implement: High

Effectiveness: Moderate (EXP)

R-10. Title: Construction of Stable Embankments (Fills)

Objective: To construct embankments with materials and methods which minimize the possibility of failure and subsequent water quality degradation.

Explanation*: Standard and Special Provisions of the Timber Sale Contract.*

Ability to implement: High

Effectiveness: High (EXP, BMPEP-R-5)

R-12. Title: Control of Construction and Maintenance Activities Adjacent to Riparian Reserves

Objective: To protect water quality by controlling construction and maintenance actions within and adjacent to Riparian Reserves so that the following riparian reserve functions are not impaired:

a. Acting as an effective filter for sediment generated by erosion from bare surfaces, road fills, dust drift, and oil traces;

b. Maintaining shade, riparian habitat (aquatic and terrestrial), and channel stabilizing effects:

c. Keeping the floodplain surface in a resistant, undisturbed condition to slow water velocities and limit erosion by flood flows.

Explanation: *Design Criteria #11. No road construction is planned for riparian reserves.*

Ability to implement: High

Effectiveness: High (EXP)

R-15. Title: Disposal of Right-of-Way and Roadside Debris

Objective: To insure that debris generated during road construction is kept out of streams and to prevent slash and debris from subsequently obstructing stream channels. To insure debris dams are not formed which obstruct fish passage, or which could result in downstream damage from high water flow surges after dam failure.

Explanation*: Road construction is not near streams.*

Ability to implement: High

Effectiveness: High (EXP)

R-16. Title: Specifying Riprap Composition

Objective: To minimize sediment production associated with the installation and utilization of riprap material.

Explanation*: Standard and Special Provisions of the Timber Sale Contract.*

Ability to implement: High

Effectiveness: High (EXP, BMPEP-R-5)

R-17. Title: Water Source Development Consistent With Water Quality Protection

Objective: To supply water for roads and fire protection while maintaining existing water quality.

Explanation: *Standard and Special Provisions of the Timber Sale Contract.* M*inimize sediment delivery using appropriate BMPs when using pump chances. Avoid wet road conditions. Use and develop off-channel ponds and decommission in-channel sites that are in conflict.*

When using pump chances, maintain riparian vegetation and stream shade. Rock access ramps where the potential for surface erosion is a concern. Do not pump from streams that do not have continuous flow. Retain at least half of the flow below the pump site.

Fish bearing streams: When using pump chances, maintain riparian vegetation and Large Woody Debris (LWD) recruitment potential. When using pump chances, install, operate, and maintain pump screens in compliance with NOAA Fisheries standards.

Ability to implement: Moderate

Effectiveness: Moderate (EXP, BMPEP-R-5)

R-18. Title: Maintenance of Roads

Objective: To maintain roads in a manner which provides for water quality protection by minimizing rutting, failures, side casting, and blockage of drainage facilities (all of which can cause sedimentation and erosion, and deteriorating watershed conditions).

Explanation: *End haul unsuitable material to a disposal area designated by a project engineer.*

Ability to implement: High

Effectiveness: High (EXP, BMPEP-R-5)

R-19. Title: Road Surface Treatment to Prevent Loss of Materials

Objective: To minimize the erosion of road surface materials and consequently reduce the

likelihood of sediment production from those areas.

Explanation: *Standard and Special Provisions of the Timber Sale Contract. For all roads used for timber haul, apply dust abatement, and erosion control as directed by a physical scientist or road engineer.*

For dust abatement, water or lignin sulfonate may be applied. These dust abatement treatment measures will be applied during dry weather or during a light rain according to the Manufacturer of the dust abatement materials, provided the dust palliative penetrates the road surface and does not flow to low areas or off of the road surface.

Rock aggregate will be added to system roads where necessary to reduce sedimentation from native surface roads or out of Normal Operating Season haul conditions. No rock aggregate will ordinarily be added to temporary landings or roads, other than spot rocking for erosion control, helping facilitate restoration of these areas. Under certain circumstances, rock aggregate may be added to temporary helicopter landings, but the rock will be removed following the completion of operations. Clean road ditches and culverts.

Rock all native-surface haul road crossings with an 8" lift of crushed rock for 100 feet on both sides of perennial and fish bearing streams.

Ability to implement: High

Effectiveness: Moderate (EXP, BMPEP-R-5)

R-20. Title: Traffic Control During Wet Periods

Objective: To reduce road surface damage and rutting of roads and to lessen sediment washing from damaged road surfaces.

Explanation: *Design Criteria #10. Temporary roads are designed to be used only during the Normal Operating Season. Road use will be suspended during wet periods to avoid road damage that cannot be repaired by typical road maintenance blading operations. Road use will also be suspended to avoid road surface runoff that will increase turbidity in streams. Also see site-specific BMP prescriptions identified for BMP R-19.*

Ability to implement: High

Effectiveness: Moderate (EXP, BMPEP-R-5)

R-21. Title: Snow Removal Controls to Avoid Resource Damage

Objective: To minimize the impact of snowmelt runoff on road surfaces and embankments and to consequently reduce the probability of sediment production resulting from snow removal operations.

Explanation*: Design Criteria #4. Standard and Special Provisions of the Timber Sale*

Contract.

Ability to implement: Moderate

Effectiveness: Moderate (EXP, BMPEP-R-5)

R-23. Road Decommissioning

Objective: To reduce sediment generated from temporary roads or unneeded system roads by decommissioning them at the completion of their intended use.

Explanation: Design Criteria #11.

Ability to implement: High

Effectiveness: High (EXP, BMPEP-R-5, MTH-AS-97, MTH-AS-99)

FUELS MANAGEMENT BMPs

F-1. Title: Fire and Fuel Management Activities

Objective: To reduce the potential public and private losses and environmental impacts which result from wildfire and/or subsequent flooding and erosion, by reducing the frequency, intensity and duration of uncharacteristic wildland fire.

Explanation: *Wherever fuel loading meets Forest Plan Standards and Guidelines, logging slash will be retained. Slash provides protection for the soil from rain splash and runoff and serves as sediment traps for surface erosion.*

Ability to implement: High

Effectiveness: Moderate (EXP, BMPEP-R-5)

WATERSHED MANAGEMENT BMPs

W-1. Title: Watershed Restoration

Objective: To repair degraded watershed conditions and improve water quality and soil stability.

Explanation: *Some skid trails, landings and roads would be decompacted and revegetated.*

Ability to implement: Moderate

Effectiveness: Moderate (EXP)

W-4. Title: Oil and Hazardous Substance Spill Contingency Plan and Spill Prevention Control & Countermeasure (SPCC) Plan

Objective: To prevent contamination of waters from accidental spills.

Explanation: *Standard and Special Provisions of the Timber Sale Contract. Storage facilities for oil products on site shall be insured that any spill will not enter any streams or other waters. If oil storage exceeds 5,000 liters (1,320 gallons) or any single containers exceed 2,500 liters (660 gallons), an SPCC plan will be prepared.*

Ability to implement: High

Effectiveness: Moderate (EXP)

W-5. Title: Cumulative Watershed Effects

Objective: To protect the beneficial uses of water and streams from the cumulative effects of multiple land management activities which individually do not create unacceptable effects, but collectively may result in adverse (degraded) water quality or stream habitat conditions.

Explanation: *Cumulative watershed effects for the Cloak Thinning Project would use the Aggregate Recovery Percentage (ARP) methodology.*

For soil resources, cumulative effects are analyzed for each harvest unit. The percentage of the unit that has been detrimentally impacted by past practices and the expected additional impact from the current proposal such as road building, logging, site preparation and fuels treatments were calculated.

Ability to implement: High

Effectiveness: Moderate (EXP)

SOILS

3/04
/S/ Gwen Collier Revised 9/23/04

The soil interpretations and recommendations presented in this report were developed from field visits in 2002 and 2004, office interpretation of aerial photos, the Soil Resource Inventory (SRI) for the Mt. Hood National Forest (Howes,1979) containing a general map of the soils associated with landforms in the Cloak analysis area, and updated soil mapping in the Last, June, Kink, and Pint Project Opportunity Areas (POAs). (Boyer, 1989, 1990).

Existing Situation

Geology

The Cloak project area lies at the boundary between the Western Cascade and High Cascade physiographic provinces. The Western Cascade Province consists chiefly of dark colored lava flows, light colored pyroclastic flows, and associated intrusions. These rocks dip slightly eastward, are often deeply weathered and may be rich in clay. The younger High Cascade Province generally consists of dark, unaltered basaltic and andesitic lava flows that tend to be less deeply weathered. Large-scale geologic mapping by Hammond et. al. (1982) identified six geologic units in the project area. The units are briefly described in their order of occurrence, youngest to oldest, followed by lists of Cloak timber sale units located on each geologic unit. Cloak units listed more than once are located on multiple geologic types.

Surficial deposits:

Qls Landslide deposits: Unsorted deposits up to 30 meters thick of clay to boulder size detritus, locally incorporating glacial deposits, talus, and colluvium, but consisting generally of bedrock units. Locally, these deposits vary from stable to active, and some were probably active during the last interglacial. *Cloak units: 497, 498, 499, 500, 501, 502, 503, 504, 507, 508, 509, 515, 516, 566.*

Qyt Younger Till: Unsorted compact deposits up to 20 meters thick of clay to boulder size detritus deposited by alpine glaciers, forming moraines mantling valley floors and slopes. *Cloak units: 427, 428, 465, 467, 469, 472, 473, 474, 476, 477, 478, 479, 481, and 571.*

High Cascade Bedrock Units:

QTb Older Basalts and Basaltic Andesite: Consists of gray blocky to platy jointed aa lava flows with a variety of interbed material. This formation often forms ridge crests and may be concealed by glacial deposits. Maximum thickness is about 425 meters. *Cloak units: 468, 470, 471, 474, 475, 477, 480, and 511, 512, 513, 514, 517, 518, 519, 520, 567, 568, 577, 578, 579, 580.*

Western Cascade Bedrock Units:

Tr Rhododendron Formation: Gray pyroxene andesite porphyry lava flows and light-colored laharic deposits with individual thicknesses up to 45 meters, and pyroclastic deposits up to 180 meters thick. Total formation thickness is about 915 meters. *Cloak units: 426, 437, 465, 466, 467, 468, 469, 480, 504, and 505.*

Tgr Grande Ronde Basalt: Basaltic lava flows originating from eastern sources. The flows interfinger with the lower Beds of Bull Creek and the overlying Rhododendron formation. Total formation thickness is about 370 meters, with individual flows ranging from 10 to 90 meters thick. *Cloak units: 426, 437, 465, 466, 467, 468, 469, 480*, and *502, 504, 505.*

Tbc Beds of Bull Creek: Consist of dark brown to gray interstratified laharic deposits, thinner fluvial volcaniclastic conglomerates and sandstones, and minor andesitic and basaltic lava flows. Maximum exposed thickness is about 375 meters. *Cloak units: 494, 495, 496, 506, and 510.*

Earthflows

Analysis Methodology: The Forest plan measures potential impacts to earthflow stability by percent of

earthflow in a 'fully recovered' state. Acreage with trees at least 8 inches diameter breast height (approximately 25 years of age) in stands of at least 70% crown closure are considered fully recovered. Trees having these characteristics are thought to allow for adequate snow interception and evapotranspiration rates which do not result in detrimental increases in groundwater levels. An incremental recovery is calculated for thinned stands and for stands less than 25 years in age. The Forest Plan has assigned each earthflow with a risk rating based on geomorphology and downslope consequences of failure, and has set the minimum recovery level for High risk earthflows at 90% recovered (B8-031), and Moderate risk earthflows at 75% recovered (B8-032).

Three earthflows occur within the Cloak project area. See Table 3 for information on risk categories and existing 2005 recovery levels. Some areas within and adjacent to proposed units located on earthflows are exhibiting localized movement. Active slumping, large cracks in the ground, a split tree trunk, and dips in the 4640 road surface were found adjacent to Unit 500. Active landslide areas have been excluded from Unit 506. Evidence of past landslides, scarps and slide blocks on steep ground, were also observed in unit 506, but no movement has occurred in the last 200 years, as large trees (now stumps) were growing in the landslide features. Stable slump landforms were found in other proposed units on earthflows.

Soils

Soils in the project area have been derived from weathering of the geologic units mentioned above. Within the project area the Western Cascade bedrock units and landslide deposits form soils mapped as 100, 100G, 101, 101H, 101P, 102, 102P, 104, 105, 106, 108, and 109. The basaltic andesites form soils mapped as 201. The glacial till deposits form soils mapped as 304, 305, 306, 306B, 306R, 306W, 306X, 307, 308, 315, 316B, 320, 323, 324, 325, and 332 (Howes, 1979), (Boyer, 1989, 1990). Updated mapping has occurred in the areas of Cloak units 428U, 473–480 (Last POA, 1990), units 426, 427, 437, 469 (June POA, 1990), units 501–504, 507–509, 511, 520 (Kink POA, 1989), and units 566, 567 (Pint POA, 1990). Within any soil-mapping unit, there is a possibility of finding up to 25% inclusions of other associated soils and/or bedrock outcrops. Soil characteristics for soil mapping units within proposed timber sale units are listed in Table 1.

Table 1. Soil Mapping Unit Attributes

Soil Mapping Unit (*Timber sale Unit #)*	Landform	Surface Soil Texture, % course fragments	Surface Erosion Potential	Compaction Hazard	Susceptibility to Soil Displacement	Sedimentation Yield Potential
MU 15 ***(501, 502, 504)***	**steep to very steep, unstable drainageways**		**Very Severe**	**Low**	**High**	**High**
MU 15A ***(502)***	**drainageways and earthflow masses, slightly unstable**		**Very Severe**	**Low**	**High**	**High**
MU 100 ***(497,498, 499, 500, 510, 514, 520)***	**Earthflow- nearly level to gently sloping, slightly uneven benches**	**heavy loam to silty clay loam, 5%,**	**Moderate - Severe**	**High**	**Moderate**	**High**
MU 100G ***(501, 503, 507, 508, 566)***	**similar to 100, but with glacial debris as the dominant parent material**		**Moderate - Severe**	**High**	**Moderate**	**High**
MU 101 ***(501)***	**Earthflow- steep, slightly uneven to dissected north and east slopes**	**heavy loam to silty clay loam, 10-15%**	**Severe**	High	**Moderate - High**	High
MU 101H ***(502, 503)***	**Mass failure headwalls within the earthflow mass**		**Severe**	High	**Moderate - High**	High
MU 101P ***(503, 509)***	**east and north facing sides of pressure ridges associated with earthflow masses**		Severe	Moderate - High	**Moderate - High**	High
MU 102 ***(500, 506, 508)***	**steep, slightly uneven to dissected south and west slopes**	**heavy loam to silty clay loam, 15-20%**	Severe	**High**	**Moderate - High**	**High**
MU 102P ***(501, 503)***	**south and west facing sides of pressure ridges associated with earthflow masses**		Severe	**Moderate - High**	**Moderate - High**	**High**

MU 104 *(494)*	**nearly level to sloping, smooth to slightly uneven mountain slopes**	**cobbly sandy loam to cobbly silt loam, 20-30%**	**Slight - Moderate**	**Moderate - High**	**Low - Moderate**	**Moderate**
MU 105 *(494, 495, 496)*	**steep, uneven to dissected north and east slopes**	**gravelly loam & cobbly silt loam, 30-35%**	**Moderate – Severe**	**Moderate**	**High**	**Moderate - High**
MU 106 *(496)*	**steep, uneven to dissected south and west slopes**	**gravelly loam & cobbly silt loam, 30-40%**	**Moderate – Severe**	**Moderate**	**High**	**Moderate - High**
MU 108 *(506, 510)*	**very steep south and west slopes**	**gravelly silt loams & silt loams, 30-40%**	**Severe**	**Moderate**	**High**	**High**
MU 109 *(494, 495)*	**very steep north and east slopes**	**gravelly silt loams & silt loams, 35-45%**	**Severe**	**Moderate**	**High**	**High**
MU 304 *(475)*	**Nearly level to undulating sideslopes**	**gravelly and cobbly loams, 30-60%**	**Slight**	**Low-Moderate**	**Low**	**Low**
MU 304S *(475)*						
MU 305 *(516)*	**Steep north and east slopes**	**gravelly and cobbly loams, 40-50%**	**Slight-Moderate**	**Low**	**Low-Moderate**	**Low**
MU 306 *(520, 571, 426, 427, 428, 437, 465, 468, 472, 473, 477, 478, 479, 480, 481)*	**Gentle mountain slopes**	**loams, 20%**	**Slight**	**Moderate**	**Low**	**Low-Moderate**
MU 306B *(472, 473, 474, 476, 477, 479, 480)*	**bench or terrace-like, convex to slightly concave side slopes of 10 to 40%**	**shotty, sandy loam, 20-30%**		**Moderate**	**Low**	
MU 306R *(476, 477)*	**broad ridge top benches with slope gradients of 0 to 30%, but more often less than 10%**	**gravelly sandy loam, 30-60%**		**Moderate**	**Low**	
MU 306W *(476, 478)*	**drainageways that contain perennial streams and wet areas**	**gravelly sandy loam**		**Moderate - High**	**Low-Moderate**	
MU 306X *(474)*	**basin and intermittent stream course positions**	**gravelly sandy loam**		**Moderate**	**Low**	
MU 307 *(514, 515, 516, 426, 428, 437, 469, 470, 471)*	**Steep, north and east facing slopes**	**loams, 15%**	**Moderate**	**Moderate**	**Low-Moderate**	**Moderate**
MU 308 *(577, 465, 466, 467, 468, 469, 477)*	**Steep south and east facing slopes**	**loams, 15-20%**	**Moderate**	**Moderate**	**Low-Moderate**	**Low-Moderate**
MU 315 *(503, 505, 506, 567)* **complex 315-5** *(505)*	**Nearly level to sloping, smooth to slightly undulating slopes MU 5: pyroclastic rock outcrops**	**gravelly loams, 30-40%**	**Slight-Moderate**	**Moderate**	**Low-Moderate**	**Low-Moderate**
MU 316B *(504)*	**steep uneven slopes, less stable than 316**	**gravelly and stoney loams, 30-70%**	**Moderate**	**Moderate**	**Moderate - High**	**Moderate**

MU 320 ***(578, 579)***	**Nearly level to steep smooth slopes**	**gravelly loams & gravelly silt loams 40-50%**	**Slight**	**Moderate**	**Low**	**Low**
MU 323 ***(505, 511, 512, 513, 517, 518, 519, 580, 475)***	**Nearly level to sloping, smooth glaciated uplands**	**gravelly silt loams, 30-60%**	**Slight**	**Moderate**	**Moderate**	**Low**
MU 324 ***(505, 518, 580)***	**Sloping to steep, south and west facing, smooth glaciated uplands**	**gravelly silt loams, 20-40%**	**Moderate**	**Moderate**	**Moderate**	**Low-Moderate**
MU 325 ***(511, 512, 567, 568)***	**Sloping to steep, north and east facing smooth glaciated uplands**	**gravelly silt loams 30%**	**Moderate**	**Moderate**	**Moderate**	**Low-Moderate**
MU 332 ***(578)***	**Moderately steep to steep, smooth glaciated mountain slopes**	**gravelly loams 40%**	**Slight-Moderate**	**Low - Moderate**	**Low**	**Low**

Detrimental Soil Condition. The percentage of area in a detrimental soil condition varies from stand to stand due to the occurrence, manner, and extent of past timber harvest and fuel treatment activities. Most of the proposed units were clear cut harvested and broadcast burned or machine piled in the 1940's, 1950's and 1960's. The natural stands have had little if any impact from previous harvest entries.

Analysis Methodology: Potential impacts caused by harvest and fuels treatment are measured by percent of harvest area in detrimental soil condition. This is a cumulative measurement that includes soil compaction, puddling, displacement, and severe burning, and their relationship to erosion and long-term site productivity. To provide for long-term site productivity the Forest Plan has a standard for detrimental impacts (a maximum of 15%, FW-022). To provide for earthflow stability the Forest Plan also has a standard for detrimental impacts soils (a maximum of 8% on earthflows, B8-040). To determine the current level of detrimental impacts to soils, the district soil scientist used field observations, surveys of units representing the various geologic categories following the Interim Protocol for Assessment and Management of Soil Quality Conditions (Wallowa-Whitman NF), and interpretation of 1949, 1952, and 1967 aerial photos. See Table 4 for existing condition by unit. Due to past management practices, seven tractor harvested units do not meet the standard for detrimental soil condition on earthflows (units 498, 499, 500, 502, 504, 508, and 509), and seven units do not meet the standard for detrimental soil condition on non-earthflow soils (units 470, 472, 476, 511, 517, 518, 519).

Organic Matter/Soil Fertility. Duff layers are relatively thin in the plantation units due to clearcutting and subsequent slash burning or piling treatments. Duff layers range from ¼ to 1½ inches with an average of ½ inch. Large down logs are also lacking in these units due to past logging and fuel treatment practices.

Soil Erosion. In the Cloak project area, surface soil erosion potential varies from slight to moderate for soils derived from glacial till and andesites and moderately severe to severe for soils derived from pyroclastics. Existing surface erosion is mainly confined to the unpaved road surfaces, road cutbanks, and ditches.

Environmental Effects

For the Cloak project, an estimate of soil disturbance resulting from proposed road building, felling and harvest activities was determined for each alternative. Table 2 shows percent of additional impact anticipated with each method, based on current condition. It was assumed landings would be re-used, and as current percent detrimental soil condition increases, it was assumed a progressively greater number of existing skidtrails would be available to be re-used. All landings and temporary roads used this entry would be subsoiled when detrimental soil conditions are greater than 15%.

Table 2.

Current % Detrimental Soil Condition	Anticipated additional impact with:				
	Mechanical felling	Ground based harvest		Skyline harvest	
		skidtrails	landings	corridors	landings
0%(no previous entry)	0.5%	7%	1%	3.5%	0.5%
0% to < 5%	"	7%	1%	2%	0%
5% to < 10%	"	3%	0%	"	"
10% to < 15%	"	2%	0%	"	"
15% to < 20%	"	1%	0%	"	"
> = 20%	"	0%	0%	"	"

Alternative A

Short-Term Effects

There would be no direct or indirect effects to soil. Percent detrimental soil condition would remain unchanged. There would be no net change in short-term surface erosion rates.

Long-Term and Cumulative Effects

Soils would continue to develop through natural processes. The percent of existing detrimental soil condition would slowly decline as compacted areas recover due to physical and biological processes. Forest organic litter input, organic decomposition rates, duff layer development and soil fauna and microbe activity would continue. Organic materials would be subject to natural disturbances such as windthrow, fire, and natural climatic change. As unthinned stands age, trees will eventually fall over in a natural thinning process. Withholding natural disasters such as insect, disease, or fire devastation, these stands should eventually produce large trees which will be a source of future large decaying logs on the ground.

Alternative B

Approximately 1242 acres of plantations and 307 acres of natural stands would be thinned. A combination of tractor, cable, and helicopter yarding would occur. Use of existing skidtrails and landings would occur where appropriate. Mechanical felling would occur in many units, depending on slope. Fertilization would occur on all plantations in the matrix (1049 acres). Forage enhancement areas of 1 to 3 acres would be created in 20 units, totaling approximately 70 acres. These areas would retain approximately 10 to 30 trees per acre.

***Earthflows**:* Thinning is planned for 333 acres located on earthflows. Forage enhancement areas are planned for 6 units located on earthflows. Table 3 identifies thinning units located on earthflows, and levels of recovery for all alternatives.

Table 3. Earthflow current information and percent recovery by alternative.

Earthflow	*Risk*	*Goal*	*Alt. A*	*Alt. B*	*Alt. C*	*Alt. D*	*Alt. E*	*Cloak units, and total acres*
Tag/Mag	Moderate	>=75%	95.8%	94 ac. 95.5%	63 ac. 95.6%	63 ac. 95.6%	94 ac. 95.5%	Units 497, 498, 499, 500
Butte	High	>=90%	96.3%	153 ac. 95.4%	112 ac. 95.7%	41 ac. 96.1%	153 ac. 95.4%	Units 501-504, 507-509
Pint	High	>=90%	91.9%	17 ac. 91.8%	14.2 ac. 91.8%	0 ac. 91.9%	17 ac. 91.8%	Unit 566

Soils

Soils and long-term productivity are protected by standards and guidelines for detrimental soil condition, and the retention of woody debris, ground cover, and live trees. All of these standards and guidelines protect soil structure and macropore space and soil organisms such as mycorrhizal fungi. Use of Best Management Practices and project design for harvest units and temporary road construction would result in meeting

objectives for soil protection and long-term site productivity involving woody debris, ground cover, and live tree retention.

Short-Term Effects

Soil Condition. Table 4 shows percent of each unit in a detrimental soil condition by alternative. Potential soil disturbances that have been considered are road and landing construction, reopening of closed roads, and felling and harvest operations. Some temporary roads would be constructed (1.8 miles), and some closed or decommissioned roads would be reopened (3.4 miles).

A net increase in detrimental soil condition is predicted where more skidtrails, yarding corridors, landings and roads would be constructed than already exist. Detrimental soil condition would remain below 15 percent in all natural stands regardless of logging system, and in all skyline units that were previously skyline logged. Units that would have greater than 15% detrimental conditions are those whose existing condition is greater than 15%, or those where a significant portion are planned for ground based systems, and had been previously tractor yarded. Compaction can be reduced through subsoiling of temporary roads and landings. Restoration of skidtrails within units would not be initiated after this thinning entry due to probable damage of tree roots adjacent to skidtrails. Subsoiling of skidtrails could be initiated after a future regeneration harvest. Restoration by subsoiling and revegetation would initiate recovery of productivity, but is unlikely to return the soil to its original condition and productivity.

Table 4. Existing and projected percent detrimental soil condition by unit and alternative.

Unit #	Earth flow	Existing	Alt. A	Alt. B & E	Alt. C	Alt. D
426		6.5	6.5	8.5	8.5	8.5
427		12.0	12.0	14.5	14.5	14.5
428		8.5	8.5	6.7	7.5	7.5
437		11.9	11.9	14.4	14.4	14.4
465		6.5	6.5	8.5	8.5	8.5
466		4.0	4.0	6.0	6.0	0
467		8.5	8.5	10.5	10.5	10.5
468		0	0	4.0	4.0	0
469		7.0	7.0	8.0	8.0	8.0
470		16.2	16.2	14.3	13.9	13.9
471		9.5	9.5	10.2	10.4	10.4
472		16.2	16.2	15.4	15.3	15.3
473		13.0	13.0	13.5	13.5	13.5
474		9.7	9.7	13.2	13.2	13.2
475		0	0	8.5	8.5	0
476		17.3	17.3	17.8	17.8	17.8
477		8.4	8.4	10.8	10.7	10.7
478		8.0	8.0	11.5	11.5	11.5
479		13.4	13.4	14.0	14.0	14.0
480		8.0	8.0	11.5	11.5	11.5
481		14.6	14.6	15.5	15.5	15.5
494		0	0	4.9	5.2	0
495		0	0	7.4	7.5	0
496		6.0	6.0	8.0	8.0	8.0
497	X	7.0	7.0	10.5	10.5	10.5
498	X	9.9	9.9	9.9	9.9	9.9
499	X	28.0	28.0	26.7	26.5	26.5
500	X	10.5	10.5	13.7	12.5	12.5
501	X	0	0	5.7	4.0	0
502	X	10.0	10.0	10.4	9.0	9.0
503	X	0	0	7.9	2.6	0
504	X	8.7	8.7	10.4	10.2	10.2

505		9.2	9.2	11.7	11.7	11.7
506		8.1	8.1	10.2	10.3	10.3
507	X	0	0	4.0	4.0	0
508	X	9.4	9.4	11.2	11.1	11.1
509	X	16.9	16.9	16.5	16.3	16.3
510	X	7.2	7.2	9.7	9.7	9.7
511		15.0	15.0	11.6	11.9	11.9
512		12.0	12.0	14.5	14.5	14.5
513		12.0	12.0	14.5	14.5	14.5
514		7.9	7.9	9.9	9.9	9.9
515		7.6	7.6	9.6	9.7	9.7
516		9.2	9.2	11.2	11.2	11.2
517		18.9	18.9	18.5	18.5	18.5
518		16.5	16.5	16.6	17.8	17.8
519		17.0	17.0	17.5	17.5	17.5
520		12.7	12.7	13.5	13.5	13.5
566	X	3.5	3.5	12.0	12.0	3.5
567		6.0	6.0	8.0	8.0	8.0
568		6.0	6.0	8.0	8.0	8.0
571		11.3	11.3	14.0	13.9	13.9
577		6.0	6.0	8.0	8.0	8.0
578		0	0	8.0	5.8	0
579		0	0	9.6	8.5	0
580		14.1	14.1	15.8	13.7	13.7

Soil Erosion. Bare soil would be exposed as logs are dragged on and machines travel over the ground surface. Approximately 32 acres of roads, skidtrails and landings would be constructed or reconstructed. Approximately 1 acre of bare skyline yarding corridors would occur. A total of 33 acres would have potential increased erosion as a result of thinning activities. Disturbed areas, particularly where slopes are greater than 25%, would be potential sources of sediment until they are revegetated successfully. Yarding within the proposed 92 acres of riparian area would expose bare soil within yarding corridors if logs were not suspended.

There is a concern about the severe and moderate to severe erosion potential of soils derived from pyroclastic materials, generally found in landslide and earthflow areas or on the adjacent steeper slopes from which the earthflow materials originated. Erosion would not occur where duff and other effective ground cover is retained. Therefore, practices which limit the amount of soil exposure, or which re-establish ground cover after soil is exposed, will result in less erosion occurring. Of the proposed yarding systems, ground based systems result in a greater amount of ground exposure than skyline and helicopter systems. Units that are prescribed for ground based systems generally have flat to gentle terrain, so even if the potential for erosion may be high, eroding materials will not move far before redeposition occurs. With Best Management Practices there is a low potential for sediment to be delivered to streams. Units 497, 499, 504, and 508 are ground based harvest units located on severely erosive soil, but the low slopes, use of designated skidtrails, and establishing effective ground cover by applying seed, fertilizer, and straw mulch on the disturbed soils (FW-025, FW-026) will aid in minimizing erosion. All other units on severely erosive soils will be logged by skyline or helicopter, resulting in a minor increase in erosion with Best Management Practices. Ground based logging on those areas of the earthflows that are high in rock, such as pressure ridges, have low erosion potentials and will result in a minimal increase in soil erosion (units 503, 509 and 566).

Organic Matter/Soil Fertility. Full suspension yarding would minimize duff disturbance in skyline operations. Designated skidtrails in ground-based yarding operations would minimize duff layer disturbance by limiting tractors to skidtrails, and minimize the amount of area over which logs are dragged across the soil surface. The net export of nutrients and carbon from the ecosystem by timber harvesting will reduce soil fertility and impact nutrient cycling. Soil microbial populations will likely be reduced initially until soil

organic matter and litter layers build back up. Leaving slash and needles where trees are felled should help maintain carbon and nutrient levels. Leaving large woody debris would benefit soil fauna and microbes, and decomposer organisms. The mitigation measure for coarse woody debris and snags, leaving 18.6 trees with wood decay per acre in natural second-growth stands and riparian areas and 5 trees with wood decay per acre elsewhere, will increase amounts of moderate-sized woody debris in the short term until larger diameter trees develop and return naturally or artificially onto the forest floor system. It is not expected that the fertilizer application will cause adverse short -term effects to soil physical, chemical, or biological functions.

Long-Term and Cumulative Effects
Soil Condition. The detrimental soil condition would slowly decline as compacted areas recover due to physical and biological processes.

Soil Erosion. Surface erosion rates would decline as exposed soils become revegetated. Soil microbial populations would slowly increase as soil organic matter and the litter layer build back up.

Organic Matter/Soil Fertility. No serious long-term adverse changes are expected in soil physical, chemical, or biological functions due to the fertilization. Currently, there is little information on which to predict positive or negative impacts to soil organisms, although it is likely there will be effects. The addition of a synthetic form of nitrogen in a form more powerful than that found in nature may cause an impact both in nutrient cycling and to the soil microflora and microfauna. Unfortunately, the scientific literature does not provide many answers on this issue, especially since most of the studies were conducted in Europe in totally different ecosystems. Fertilizer nitrogen has been found to cause changes in abundance and species composition of both saprophytic and mycorrhizal fungi (Nason and Myrold, 1992; Arnebrant *et al*. 1996), but the extent and impacts are unclear. Another study from a fertilized pine-oak forest in Poland found some understory species were favored over others, and some species completely lost their mycorrhizae (Turnau *et al*. 1992). Harvey and others (1994) found that native soil-borne pathogens such as *Armillaria* and *Phellinus* are sensitive to soil physical and chemical characteristics and concluded that the direct addition of nutrients may influence root diseases. A study in Idaho documented delayed stress reactions and damage from root rot following forest fertilization (Moore and others, 1993). There exists the possibility, that forest fertilization may impact the extent of *Phellinus* pockets in the planning area. Although fertilizer may be considered ecologically artificial, in the longer term the stage is being set to grow and manage larger pieces of woody debris and produce organic matter, thus maximizing the opportunities for site productivity without the use of synthetic fertilizers in the future.

The typical fertilizer used in forest applications in Douglas-fir forests is a synthetic urea fertilizer that has a NPK value of 46-0-0. Boyer and Legard report in 1973 that urea can be used by plants directly to some extent, but is more commonly used after converting to ammonia and nitrogen. After converting, it becomes readily soluble and subject to leaching, but ammonification considerably reduces the leaching losses. Ammonia is more likely to volatilize rather than leach due to the ionic attractions of organic matter and clay fractions within the soil. The best time of application is likely to be in the late spring, after the snow has melted, while the soil is still wet but not saturated (Nason and Myrold, 1992). If the fertilizer is applied to saturated soil, a substantial percentage of the fertilizer may leach through instead of being utilized by the trees. Soil texture can be an important determinant of the level of nitrate that reaches the groundwater. The coarser the soil texture, the faster the movement of the dissolved nitrate, and thus the lower rate of uptake of that nutrient by the vegetation. Within the project area the soil types derived from pyroclastic materials are heavy loams to silty clay loams with a coarse fragment volume of 5 to 35% and ½ to 1 ½ inch duff layer. The soil types derived from glacial materials are silt loams to sandy loams with a coarse fragment volumes of 15 to 40% and ½ to 1 ½ inch duff layer. Consequently, nitrate leaching to the groundwater is not likely.

Alternative C

Approximately 1082 acres of plantations and 250 acres of natural stands would be thinned. Thinning in riparian reserves would not occur. New roads would not be constructed (approximately 9550 feet). Helicopter yarding rather than skyline yarding would occur where road access is not available (approximately 106 acres). Approximately 27 acres of roads, skidtrails and landings would be constructed, and

approximately 0.5 acres of bare skyline yarding corridors would occur. A total of 27.5 acres would have potential increased erosion as a result of thinning activities.

Short-Term Effects
The effects of this alternative outside of riparian reserves are expected to be similar to those of alternative B, except for road and skyline corridor disturbance. This alternative would reduce the amount of soil disturbed from harvesting activities and reduce the risk for erosion from new construction and use of temporary roads. No detrimental soil effects would occur within riparian reserves adjacent to harvest units. Application of fertilizer would not occur, therefore changes in mycorrhizal populations due to fertilizer application would not occur.

Long-Term and Cumulative Effects
Cumulative effects on disturbed areas are expected to be the same as alternative B.

Alternative D
This alternative is similar to C but would eliminate the thinning of natural second growth stands (250 acres).

Short-Term Effects
Within plantations, the effects of this alternative would be similar to those of alternative C. No change in soil condition would occur within the unthinned natural second growth stands.

Long-Term and Cumulative Effects
Cumulative effects on disturbed areas are expected to be the same as alternative B.

Alternative E
This alternative is similar to B but forage enhancement areas would be 3 to 5 acres in size rather than 1 to 3 acres in size. Total acreage of forage areas would remain at 70 acres. Leave trees would be retained at a rate of 20 to 40 trees per acre rather than 10 to 30 trees per acre.

Short-Term Effects
The effects of this alternative would be similar to those of alternative B, except on earthflow units. The larger forage enhancement areas would allow for greater snow accumulation and thus quicker and greater hydrologic response from rain on snow events.

Long-Term and Cumulative Effects
Cumulative effects are expected to be the same as alternative B.

References

Arnebrant, Kristina, and others. 1996. Soil Microbial Activity in Eleven Swedish Coniferous Forests in Relation to Site Fertility and Nitrogen Fertilization. *In:* Scandinavian Journal of Forest Research 11:1-6.

Boyer, D., and H. Legard. 1973.

Boyer, D., 1989. Soil Mapping - Kink Project Opportunity Area. 1990: Soil Mapping - June, Last, and Pint Project Opportunity Areas, Clackamas Ranger District, Mt. Hood National Forest.

Hammond, P.E, K. Manning Geyer, and J.L. Anderson. 1982. Preliminary Geologic Map and Cross Sections of the Upper Clackamas and North Santiam Rivers Area, Northern Oregon Cascade Range. Department of Earth Sciences, Portland State University.

Harvey, Alan E., and others, eds. 1994. Biotic and Abiotic Processes in Eastside Ecosystems: The Effects of Management on Soil Properties, Processes and Productivity. USDA Forest Service, General Technical Report PNW-GTR-323. Portland, OR.

Howes, Steve. 1979. Soil Resource Inventory. Mt. Hood National Forest. USDA Forest Service, Pacific Northwest Region, Sandy, Oregon.

Moore J.A.et al, 1993. Nutrition and forest health. *In:* Baumgartner, D.M., ed. Interior cedar-hemlock-white pine forests: ecology and management: Symposium proceedings; March 2-4, 1993. Washington State University. Pullman, WA. As referenced in Harvey et al, 1994.

Nason, G.E., and D.D. Myrold. 1992. Nitrogen Fertilizers: Fates and Environmental Effects in Forests. *In:* Chappell, H.N., et al, eds. 1992. Forest Fertilization: Sustaining and Improving Nutrition and Growth of Western Forests. University of Washington, Institute of forest Resources Contribution #73. Seattle.

Turnau, K., et al. 1992. Mycorrhizal status of herb-layer plants in a fertilized oak-pine forest. *In:* Plant and Soil 143: 148-152.

USDA Forest Service, 1990. Land Resource Management Plan. Mt. Hood National Forest, Sandy, Oregon.

Wallowa-Whitman National Forest, USDA Forest Service, September 2001. Interim Protocol for Assessment and Management of Soil Quality Conditions. Version 3.3.

ANALYSIS OF NEW INFORMATION

Cloak Thinning

Assessment of the report titled "Scientific evaluation of the status of the Northern Spotted Owl."(SEI Report) (S P Courtney, J A Blakesley, R E Bigley, M L Cody, J P Dumbacher, R C Fleischer, AB Franklin, J F Franklin, R J Gutiérrez, J M Marzluff, L Sztukowski).

The National Environmental Policy Act (NEPA) and the Endangered Species Act (ESA) include provisions for consideration of new information relative to existing and proposed Federal activities. As ecosystem assessment findings and other science documents are released, significant new information provided by those documents needs to be considered in the decision making process for *proposed actions.* It will also need to be evaluated with respect to *ongoing actions* to determine if either NEPA supplementation or re-initiation of ESA consultation is necessary. The Cloak Thinning proposal is a proposed action. Although an Environmental Assessment has been completed, a decision on the proposal has not been made. The following concepts and definitions are provided as background to this assessment:

NEPA Issues - "significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts" [40 CFR §1502.9(c)] - the regulation is specific to Environmental Impact Statements, but Forest Service (FS) policies extend this concept to other levels of NEPA analysis (FSH 1909.15 §18). NEPA documents for proposed actions need to be reviewed with respect to the likelihood of "significant new information" warranting supplementation or revision.

ESA Issues - The ESA test is different than that of NEPA. The ESA focuses on "new information," not "significant new information." Under the ESA, re-initiation of consultation is required if "new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered" [50 CFR §402.16(b)]. Thus, while new information may not be significant under NEPA, it may reveal effects not previously considered under ESA.

Definitions:
Ongoing actions - Existing projects, activities, agreements, or special uses where the Agencies have discretion or control.

Proposed actions - Proposals which do not have a decision or those where a decision has been made, but no contract or permit has been awarded.

New information - Information not previously known or considered or that which provides new interpretations or context not considered at the time an existing decision was made.

Significant new information - New information that (1) is relevant to environmental concerns and bearing on the actions or their impacts and (2) would substantially alter the impact analyses and conclusions in existing NEPA documents. Findings of significance ultimately rest with the decision maker and would be based on evidence provided in the record.

Process for Considering New Information With Respect to Proposed Actions

Appropriate changes to NEPA documents for proposed actions are made in accordance with the CEQ regulations relating to significant new information [40 CFR §1502.9(c)], and FS NEPA Handbook 1909.15, Chapter 18. Similarly, appropriate changes with respect to ESA Section 7 consultation are made in accordance with the ESA regulations relating to re-initiation of formal consultation (50 CFR §402.16), and Forest Service policies with respect to proposed species and their habitats.

If the evaluation results in changes to NEPA documents for proposed actions, appropriate agency national, state or unit-level NEPA and other program-specific guidance should be consulted regarding requirements for public notification and any public comment periods. Where evaluations are applied, it is encouraged that findings be documented. Such documentation should be filed in the analysis file for the proposed action; this includes findings of no discretion, no new information, and non-significance where appropriate.

The following questions are organized by the various evaluation categories. Question 1 considers whether FS has discretion to alter analyses and decisions for particular proposed activities. Questions 2 through 5 then address NEPA's "significant new information" issue. (Questions 2 through 4 help determine whether the information is actually "new" and, if so, whether it is relevant to the proposed actions and would substantially alter the impact analyses and conclusions in existing NEPA documents. Question 5 looks at the potential for the new information to "raise the level" of NEPA compliance required for the action, thereby necessitating development of a new NEPA document. The remaining questions address ESA's "new information" issue.

1. Does the FS have discretion or control over the proposed action?

Yes the agency has discretion.

2. Is the information new?

Yes, some of the information is new. Monitoring of populations of Northern Spotted Owls has been ongoing for many years. After the 30-day comment period for the preliminary environmental analysis on the Cloak Thinning proposal was conducted, a report was published by Sustainable Ecosystems Institute of Portland Oregon (September 2004). The report is titled "Scientific evaluation of the status of the Northern Spotted Owl."(S P Courtney, J A Blakesley, R E Bigley, M L Cody, J P Dumbacher, R C Fleischer, AB Franklin, J F Franklin, R J Gutiérrez, J M Marzluff, L Sztukowski).

The report is a review and synthesis of information on the status of the Northern Spotted Owl. The report was prepared to aid the US Fish and Wildlife Service in their 5-year status review process, as set out in the Endangered Species Act. The report did not make recommendations on listing status, or on management, and focused on identifying the best available science, and the most appropriate interpretations of that science. The focus is on new information developed since the time of listing in 1990. The report relied on demography studies summarized in a report titled "Status And Trends In Demography Of Northern Spotted Owls, 1985–2003", Anthony et al.

The following excerpt is from the executive summary of the SEI report. The italicized portion below each paragraph gives project specific information on that topic.

> Central to understanding the status of the subspecies is an evaluation of its taxonomic status. The panel is unanimous in finding that the Northern Spotted Owl is a distinct subspecies, well differentiated from other subspecies of Spotted Owls. *This in not new information and does not change the assessment of effects for the Cloak project.*
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> The panel did not identify any genetic issues that were currently significant threats to Northern Spotted Owls, with the possible exception that the small Canadian population may be at such low levels that inbreeding, hybridization, and other effects could occur. *This information does not change the assessment of effects for the Cloak project. The Cloak project would not affect Canadian owls.*
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> The use of habitat and of prey varies through the range of the subspecies. These two factors interact with each other and also with other factors such as weather, harvest history, habitat heterogeneity etc, to affect local habitat associations. While the general conclusion still holds that Northern Spotted Owls typically need some late-successional habitat, other habitat components are also important (at least in some parts of the range). *This information does not change the assessment of effects for the Cloak project.*
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> The available data on habitat distribution and trends are somewhat limited. Development of new habitat is predicted under some models. However our ability to evaluate habitat trends is hampered by the lack of an adequate baseline. Given these caveats, the best available data suggest that timber harvest has decreased greatly since the time of listing, and that a major cause of habitat loss on federal lands is fire. In the future, Sudden Oak Death may become a threat to habitat in parts of the subspecies' range. *This information does not change the assessment of effects for the Cloak project. There have been no large fires in the Cloak area in recent years. Sudden Oak Death has not been found in the Cloak area.*
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> Barred Owls are an invasive species, that may have competitive effects on Northern Spotted Owls (as was recognized at the time of listing). Opinion on the panel was divided on the effects of Barred Owls. While all panelists thought this was a major threat, some panelists felt that the scientific case for the effects of

Barred Owls remained inconclusive; other panelists were more certain on this issue. *This information does not change the assessment of effects for the Cloak project. Barred owls are discussed in the EA, p. 50.*

The demography of the Northern Spotted Owl has been recently summarized in a meta-analysis (Anthony et al 2004), which is the most appropriate source for information on trends. Although the overall population, and some individual populations show signs of decline, we cannot determine whether these rates are lower than predicted under the Northwest Forest Plan (since there is no baseline prediction under that plan). However the decline of all four Washington state study populations was not predicted, and may indicate that conditions in that state are less suitable for Northern Spotted Owls. Several reasons for this pattern are plausible (including harvest history, Barred Owls, weather). *The Cloak project area was not part of the demographic studies summarized by Anthony et al. (2004). Of the 14 study areas, two are nearby. The estimated spotted owl population declines on the Warm Springs Indian Reservation were indicated to be substantial over the last decade where population sizes were only 40-60% of the initial population size of 1992. The Warm Springs study involved east-side forest conditions and harvest rates greater than on Federal forests. Declines on the H.J. Andrews study area were not as great with 70-80% of the 1987 initial population size in that area. The data from the report suggested that populations over all of the 14 study areas were declining about 4% per year during the study. It also was suggested that owl populations on federal lands had better demographic rates than elsewhere and that populations were doing poorest in Washington. This information does not change the assessment of effects for the Cloak project.*

There is currently little information on predation on Spotted Owls, and no empirical support for the hypothesis, advanced at the time of listing, that fragmentation of forest after harvest increases predation risk. *This information does not change the assessment of effects for the Cloak project. The Cloak project is a thinning that would not fragment habitat.*

West Nile Virus is a potential threat, but of uncertain magnitude and effect. *This information does not change the assessment of effects for the Cloak project. West Nile Virus has not been identified in the Cloak project area.*

In general, conservation strategies for the Northern Spotted Owl are based on sound scientific principles and findings, which have not substantially altered since the time of listing (1990), the Final Draft Recovery Plan (1992) and adoption of the Northwest Forest Plan (1994). Nevertheless we identify several aspects of conservation and forest management that may increase both short and medium term risks to the species. These are typically due to failures of implementation.

A full evaluation of the uncertainties of the data, the conclusions that can be drawn from them, and of the perceived threats to the subspecies, are shown in the summary of individual panelist responses to a questionnaire.

Major threats to Northern Spotted Owls at this time include: the effects of past and current harvest; loss of habitat to fire; Barred Owls. Other threats are also present. Of threats identified at the time of listing, only one (predation linked to fragmentation) does not now appear well supported.

3. Is the new information relevant to environmental concerns for this action?

Yes. The Cloak thinning project could affect Northern Spotted Owls because the proposal would downgrade 86 acres of nesting/roosting/foraging habitat to dispersal habitat for a period of approximately 15 years (at that time the tree canopies would grow to the point where owls could use the area for nesting/roosting/foraging). The other units would degrade dispersal habitat for approximately 15 years until the canopies grow and fill the available space.

4. Does the new information tell you something substantially different about effects of the proposed action?

No. The reports are new but they summarize trends that were predicted at the time of the Northwest Forest Plan. It was predicted that Northern Spotted Owl populations would decline. The reports do not contain any information specific to the Cloak thinning proposal or this specific area. The reports are broad scale assessments that look at the Northern Spotted Owl throughout its range. The reports do not contain any information that would substantially change the analysis or conclusions in the Cloak EA concerning the impacts on the Northern Spotted Owl.

The Cloak thinning proposal is consistent with the land allocations and standards and guidelines of the Northwest Forest Plan. The Cloak project is a thinning designed to improve forest health and growth and result in increased biological diversity and larger trees.

The report however does make some general recommendations about thinning of forest stands as it relates to owl habitat and owl prey relationships. The report notes thinnings that promote species diversity, variable thinning densities and interruptions in the forest canopy, hold promise for accelerating the development of spotted owl habitat and dense prey populations over conventional thinning (single species with uniform density). This is not new information since the time of the Cloak EA since it is synthesizing research conducted between 1994 and 2002. The proposed action is consistent with these objectives. The Cloak thinning proposal includes measures that will promote maintaining species diversity, and variable densities including interruptions in the forest canopy. This information does not change any conclusions in the Cloak EA in any substantial way.

5. Does the magnitude of changed effects require a different level of NEPA analysis than was originally applied?

No. The new information did not substantially change the effects on the Northern Spotted Owl that were analyzed in the Cloak EA.

6. Is the new information relative to the proposed action involving potentially affected federally listed or proposed species and/or ESA designated or proposed critical habitats?

Yes. The new information is specifically about a federally listed species, the Northern Spotted Owl. The Cloak thinning proposal would affect this species.

7. Does the new information reveal effects to federally listed or proposed species and/or designated or proposed critical habitats in a manner or to an extent not previously considered.

No. The information does not reveal effects concerning the impacts of the Cloak thinning proposal in a manner or extent not previously considered. See question 4.

Based on the assessment of this new information I have determined that the information is not significant for the Cloak Thinning proposal because it does not alter the analysis or conclusions concerning the Northern Spotted Owl in the Cloak EA. Therefore a supplemental or new EA is not required. I have also determined that the information did not reveal any effects the Cloak thinning proposal would have on the Northern Spotted Owl that were not previously considered. Therefore re-initiation of ESA consultation with the USFWS is not required.

/S/ *Andrei Rykoff* 11/10/04

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