Appendix F

AQUATIC INFORMATION

Roads can increase mass wasting (landslide frequency) and sediment delivery to streams (AQ-3) (AQ-4)

The detrimental impacts of roads on erosional processes are large in magnitude and long in duration. Roads produce a wide range of geomorphic responses to the aquatic environment that varies from chronic, long-term contributions of relatively small volumes of sediment flux into streams to large episodic contributions of sediment resulting from slope mass failure (landslides). This effect, combined with the removal of large wood from stream systems from the past legacy of riparian logging has facilitated the rapid transport of large amounts of sediment through stream networks[F-1].

Road-related landslides consist of rapid-moving, shallow-seated (<5 meter) debris avalanches and in-channel debris flows that occur principally in steep, well dissected terrain; and slower-moving, deeper-seated (>5 meter) rotational slumps, earthflows, and related soil creep that are typically associated more with weakly-dissected landscapes containing deep weathering zones[F-2]. Landscapes characterized by extensive complexes of slump-earthflow features at varying levels of activity are known as earthflow terrain.

In an unmanaged forest landscape landslides are an intrinsic and episodic disturbance regime that contribute to proper ecosystem functioning by delivering fine- and coarse-textured sediment and large wood to higher order stream channels. The large wood component of a landslide deposit provides a key structural element within stream channels that's effectively dissipates flow energy, stores sediment flux, and creates channel complexity. Large woody debris thus plays a critical role in maintaining habitat diversity for fish and other aquatic organisms[F-3].

[F-1] Furniss, M.J., T.D. Roelofs, and C.S. Yee. 1991. Road construction and maintenance. *In:* Meeham, William R. (Ed.). Influences of Forest and Rangeland Management on Salmonid Fishes and their Habitats. U.S. Department of Agriculture, Forest Service: American Fisheries Society Special Publication 19, 297-323.

[F-2] Swanson, Frederick J., and Douglas N. Swanston. 1977. Complex mass-movement terrains in the western Oregon Cascade

Range, Oregon. Geological Society of America, Reviews in Engineering Geology, v. III, 113-124.

[F-3] Fetherston, Kevin L., Robert J. Naiman, and Robert E. Bilby. 1995. Large woody debris, physical process, and riparian forest development in montane river networks of the Pacific Northwest. Geomorphology, v. 13, 133-144.

Current Situation

Debris avalanches and debris flows occur naturally, but the presence of roads can increase the potential for their occurrence during moderate and severe storm events. The relative volume of displaced soil mass resulting from debris avalanches in roaded areas relative to that of an unmanaged forested landscape based on field investigations conducted at two study sites located in the western Cascade Range, the H. J. Andrews Experimental Forest and Alder Creek drainage. Results from this study reveal that when normalized to the area of actual disturbance, the volume of displaced soil mass by debris avalanches (expressed as m^3 per km^2 /yr) along roads ranged from 49 to 344 times that of an unmanged forest landscape. The relative frequency of debris flow occurrence in roaded areas relative to that of an unmanaged forested landscape based upon the same two study sites in the western Cascade Range. The findings of this study indicate that when normalized to the area of actual disturbance that the rate of debris flow occurrence (expressed as number of landslide features per km^2 per yr.) along roads ranged from 42 to 133 times that of an unmanged forest landscape[F-4].

Debris avalanches typically deliver only a fraction of the failed (displaced) sediment volume into aquatic habitat, whereas debris flows cause extensive scour along steep channel reaches with deposition occurring at gentler gradients. The distance a debris flow travels is largely influenced by the volume of mobilized material and stream channel characteristics, such as gradient and angle of downstream tributary confluences[F-5].

Debris flows typically produce the most severe and long-lasting impact to stream channels in high-relief mountainous terrain. The detrimental effects of debris flows may include drastic alteration of channel cross section and profile, loss of riparian canopy, large-scale movement and redistribution of bed-load gravel and associated organic materials (large woody debris), damming and obstruction of channels, and accelerated bank erosion and undercutting. Debris flow scour often causes simplified channel morphology that accelerates sediment transport due to decreased channel roughness and the lack of obstructions that accumulate and temporarily store sediment bedload. Simplified channel morphology reduces available places of refuge for fish during peak flow events[F-6].

Risk factors for road-related landslides include the following: mid-slope roads, roads built using side-cast construction techniques where unstable fills can become saturated and fail, and culverts (mainly at road stream crossings) that are either hydraulically undersized for large storm events or become plugged by sediment and organic debris. Site failures at road

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[F-4] Swanston, Douglas N., and Frederick J. Swanson. 1976. Timber harvesting, mass erosion, and steepland forest geomorphology in the Pacific Northwest. *In:* Coates, Donald R.(Ed.). Geomorphology and Engineering, Dowden, Hutchinson & Ross, Inc.: Stroudsburg, Pennsylvania, 199-221.

[F-5] Benda, Lee and Terrance Cundy. 1990. Predicting deposition of debris flows in mountain channels: Canadian Geotechnical Journal, v. 27, 409-417.

[F-6] Montgomery, David R., and John M. Buffington. 1993. Channel classification, prediction of channel response, and assessment of channel condition. Timber, Fish, and Wildlife Report, TFW-SH10-93-002.

stream crossings may result in overtopping (washout) or stream channel diversion down the ditch. Stream channels that divert flow down ditch lines often trigger landslides and deliver large volumes of sediment flux into stream channels[F-7]. Roads constructed through areas of semi-active to highly active earthflow terrain tend to be very costly due to chronic levels of road maintenance and frequent site repairs.

District Engineers on the Umpqua National Forest were asked to identify five roads on their District that were costly in terms of frequent road maintenance caused by slope instability. Response from District Engineers is displayed in **Table F-1**. Many of the road systems listed are traverse through areas of semi-active to active earthflow terrain.

Table F-1. High Maintenance Roads Identified by District Engineers

Cottage Grove RD	Diamond Lake RD	North Umpqua RD	Tiller RD
1700-000 – Layng - Patterson	4775-000 – Medicine Cr.	2500-000 – Cavitt Cr.	2800-000 – S. Umpqua River
1721-000 – June Mtn.	2801-000 – E. Copeland Cr.	2500-050 – Tuttle Cr.	2900-000 – Collins Ridge
1746-000 – Holland Meadow	2800-000 – Copeland Cr.	2700-000 – Little River	2925-000 – Black Canyon
1746-750 – n/a		2719-000 – Black Cr.	3230-000 – Callahan Cr.
1746-763 – Swastika		4714-000 – Panther Cr.	
2200-000 – Brice Cr.		4770-000 – Wilson Cr.	
2241-000 – Adams Mtn.			
2263-000 – Cat Cr.			
2263-717 – Dog Cr.			
2358-000 – Canton Pt.			

Until the early 1970's, Forest roads were commonly constructed using side-cast construction techniques, where excavated material from large cuts was simply pushed over the side of the road to create a shoulder. Sliver fills usually contained large amounts of woody debris. These older roads typically routed intercepted groundwater exiting from cut slopes into sensitive concave areas that are prone to landslide occurrence. As a result, the older roads tend to have the higher potential for increased risk of landslides.

Beginning in the early- to mid-1990's the Umpqua National Forest began to conduct localized road inventories to identify areas of instability for planned watershed restoration projects. With the advent of the Northwest Forest Plan and watershed analyses in 1994 the Forest began to have limited contracts for inventorying stream crossings at the scale of fifth field watersheds. Road inventory today takes place at the project level.

[F-7] Furniss, M.J., T.D. Roelofs, and C.S. Yee. 1991. Road construction and maintenance. *In:* Meeham, William R. (Ed.), Influences of Forest and Rangeland Management on Salmonid Fishes and their Habitats. U.S. Department of Agriculture, Forest Service: American Fisheries Society Special Publication 19, 297-323.

Risks and Benefits

Mid-slope roads crossing stream channels on steep dissected ground that receive little or no maintenance pose the highest risk of initiating debris flows. Debris flows originating from failed road stream crossing intersections often results in small amounts of large wood being placed into streams. The large sediment flux caused from failed road fills at stream crossings generally causes short-term detrimental effects to aquatic habitat, including aggrading channel beds, in-filling of pools, and covering existing spawning gravel with fine sediment.

Recommendations

1) Identify road systems that are at highest risk for mass wasting (landslides) and mobilizing sediment into the aquatic ecosystem. If they are part of the future Forest road network (infrastructure) consider stabilizing them; if not, consider placing them in temporary closure (storage) or decommissioning them. Tools useful to prepare this analysis are:

   - Consider using the SHALSTAB digital terrain model that delineates steep concave slope forms that represent preferred sites for the initiation of rapid-shallow landslides. The SHALSTAB digital terrain model is contained in the Geographical Inventory System under the path file *I:/ump/soil/ump_stability*. Refer to **Attachment F-1** at the end the Aquatic Issues Section for a description, application, and limitations of the SHALSTAB digital terrain model for project-level slope stability analysis.

   - Consider utilizing geomorphic landform maps from completed watershed analyses that outlines areas of earthflow terrain on the Forest. A unified map of earthflow terrain derived from completed watershed analyses on the Forest is contained in the Geographical Inventory System under the path file

   I:/geology_arcview/av_shapes/new_geom./landslide_earthflow/terrain.

   - Consider modeling stream channel gradients and junction angles to delineate stream channels that are at risk to in-channel debris flows. Such a model was developed in areas of the Umpqua National Forest affected by wildfires during the summer of 2002. A preliminary debris flow model was prepared for WEEP (Wildfire Effects Evaluation Project).

   - Consider utilizing available road stream crossing (culvert) inventories from previous watershed analyses to determine the potential for mass failure at specific sites. Although the Forest has adopted and modified several methods of inventorying various aspects of potential road concerns, it is suggested that for evaluating hydraulic risk at road stream crossings to utilize the methodology outlined in **Attachments H-1** and **H-2** contained in **APPENDIX H**. This method integrates hydraulic risk of a road stream crossing at a Q_{100} event with consequences, estimated volume of deliverable sediment in aquatic habitat.

(2) For road systems that the Forest intends to maintain and utilize for future management activities, consider replacing or upgrading culverts to meet Q_{100} peak flows. At road stream crossings where stream channel diversion presently exists, consider constructing rolling grade sags to keep the stream in its channel in the event of culvert failure (overtopping) by plugging or capacity overload.

(3) For road systems that the Forest intends to maintain and utilize for future management needs (depending upon land allocation), consider temporary road closure (place in storage) or permanently close the road (decommission) by removing fills and culverts at road stream crossing intersections.

Roads can generate surface erosion and increase the potential for fine sediment delivery to streams (AQ-2)

Surface erosion along roads is manifested by a variety of gravity and water-driven processes that include: dry ravel, freeze-thaw, rain splash impact, sheet wash, rilling, and gullying. Surface erosion can become a significant contributor of sediment yield into the aquatic ecosystem when the vegetative cover is removed and the soil mantle disrupted by intensive logging operations (mainly tractor logging), road construction, or wildfire[F-8].

Chronic levels of surface and fluvial erosion that stem from barren road surfaces and sparsely vegetated cut slopes, fill slopes, and ditches represent an significant potential supply of mostly fine-textured sediment flux that may reach and enter into stream channels. Generally this sediment load is conveyed along ditch lines that feed directly into streams.

Sediment diverted off the road surface and out of ditches is usually deposited at the base of the fills slope where it is filtered out into the vegetation before reaching a stream channel. Cross drains, water bars, and drain dips (sags) are constructed at frequent intervals along roads to facilitate the transfer of water and fine sediment out of the ditch prior to reaching a stream channel. Where the spacing of these structures is inadequate some level of fine sediment flux traveling down ditches is delivered directly into stream channels.

Current Situation

The dense vegetation cover and high infiltration (permeability) rates of most soils on the Umpqua National Forest results in negligible to very low levels of surface erosion. Surface erosion from roads can occur where steep, sparsely vegetated cut slopes are present, in ditch lines (especially those with moderate to steep gradients), and from road surfaces that lack gravel aggregate or asphalt.

Granite and schistose bedrock of the Klamath Mountains province that underlies portions of the Cow Creek and Elk Creek sixth field watersheds, as well as poorly consolidated Mazama ash deposits in areas on the Diamond Lake Ranger District have a strong inherent susceptibility to surface erosion processes. Roads located in highly weathered and variably decomposed granitic and schistose bedrock are considered to pose a high risk for generating fine sediment from both surface erosion processes and mass wasting (landsliding). In September 1979 the Tiller Ranger District issued a guidelines policy for conducting land management practices of road construction and timber harvest prescriptions in area underlain by granitic soils. In October 1995, this Tiller Ranger District

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[F-8] Reid, Leslie M. and Thomas Dunne. 1996. Rapid Evaluation of Sediment Budgets. CATENA: Verlag GMBH, 33447 Reiskirchen, Germany (GeoEcology paperback).

revised and expanded this document during the Cow Creek Watershed Analysis to include schistose soils. The 1995 Tiller Granite – Schist Policy is contained in **Attachment F-2**.

Poorly consolidated deposits of ash and pumice resulting from the cataclysmic eruption of Mt. Mazama some 7500 years before present blanket large areas surrounding the Diamond Lake – Lemolo Lake vicinity and extend down into the North Umpqua canyon to Copeland Creek. Most of these ashy deposits veneer gentle gradient slopes, but where exposed in road cuts these deposits can be quite erosive if not properly designed.

The aerial extent of highly erosive soils on the Forest is portrayed in **Map F-1**. The erosive soils depicted on this map are mainly derived from the 1:500,000 scale State Geologic map[F-9]. The earthflow terrain shown on this map represents a compilation from completed watershed analyses on the Forest.

Risks and Benefits

Fine sediment generated by surface erosion along road systems can enter into streams. Most of the streams on the Forest are high energy and thus function primarily to transport sediment bedload. The impact of increase sediment levels entering into the aquatic ecosystem is largely dependent on stream channel characteristics and proximity to fish habitat[F-10]. Fine sediment generated from roads and delivered to streams may be deposited in localized reaches where fish habitat is present. Sediment flux may fill pools and cause gravel deposits used for spawning to become embedded or covered thus reducing the quality of fish habitat.

Recommendations

(1) Consider leaving ditch lines vegetated as often as possible. Vegetation serves as a filter that reduces the amount of fine sediment that reaches road stream crossings.

(2) Consider providing an adequate covering of surface aggregate on key (primary and secondary) road systems that will remain open.

(3) Consider restricting timber haul on sensitive roads to the dry season. If timber haul must take place during the wet season, monitor rainfall, and reduce or curtail timber haul during periods of prolonged or intense rainfall.

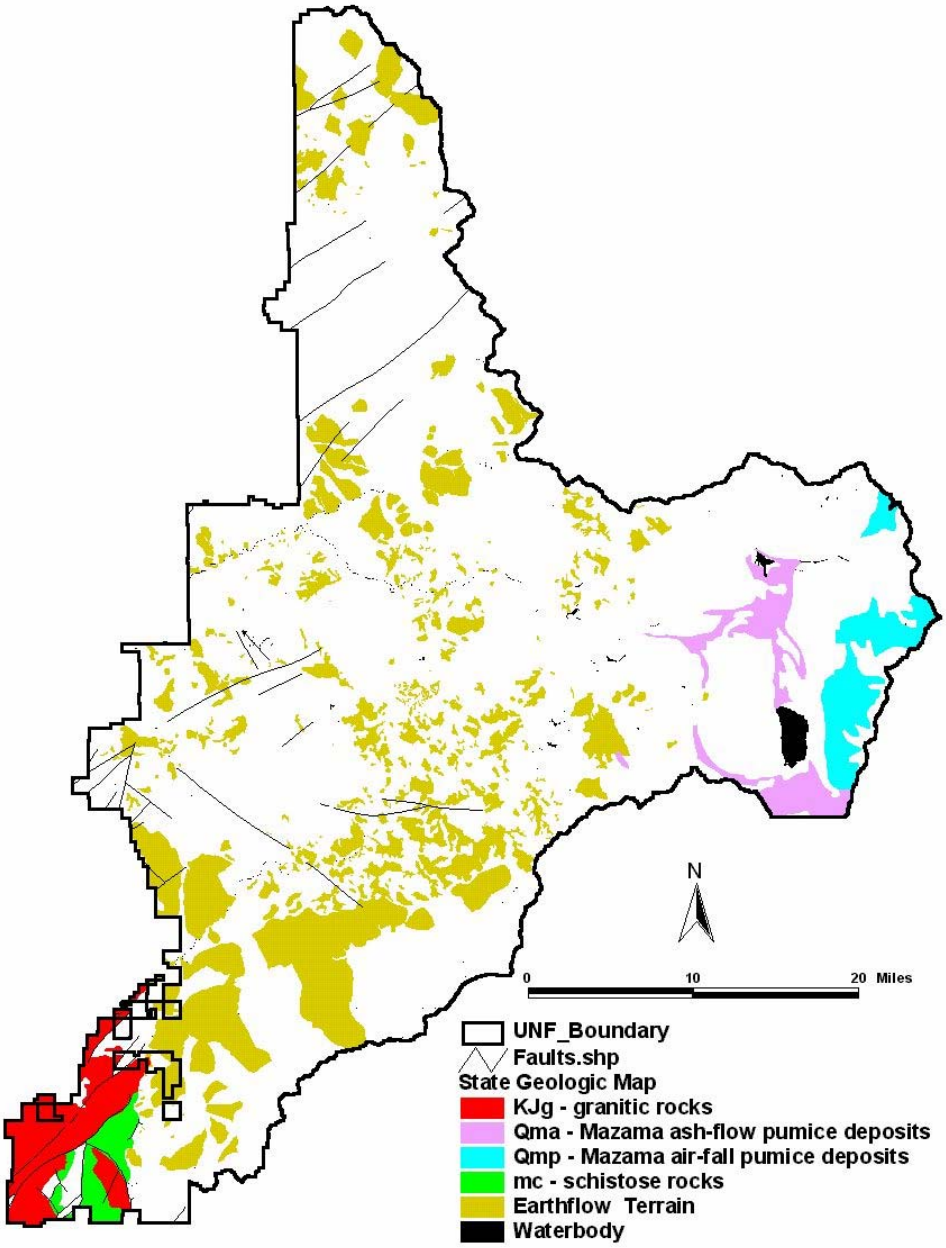
(4) Consider disconnecting roads from streams by installing and maintain water bars, rolling grade sags, and drain dips on roads not intended for passenger cars. For primary and secondary roads also consider increasing the frequency of ditch relief culverts (cross drains) in the vicinity of streams where ditch scour is present.

(5) Consider utilizing the WEPP (Watershed Erosion Prediction Project) model overland movement of sediment resulting from roads.

[F-9] Walker, George W. and Norman S. MacLeod (Compilers). 1991. Geologic map of Oregon. U.S. Dept. of Interior, Geological Survey, pl., 1:500,000.

[F-10] Swanston, Douglas N., and Frederick J. Swanson. 1976. Timber harvesting, mass erosion, and steepland forest geomorphology in the Pacific Northwest. *In:* Coates, Donald R.(Ed.). Geomorphology and Engineering, Dowden, Hutchinson & Ross, Inc.: Stroudsburg, Pennsylvania, 199-221.

Map F-1. Highly erosive soils of Umpqua National Forest



Roads can affect water quality and the beneficial uses of water AQ(7)

Water Quality and Beneficial Uses

Road construction, maintenance, reconstruction or decommissioning can change water quality by removing trees that shade and stabilize streambanks. Roads can cause surface erosion and landslides to deliver more sediment to streams than they historically carried, and can increase flood flows that scour channels. Watershed analyses highlight how and where roads have affected water quality (see Current Conditions below). On some streams, water quality standards are violated. The locations of the violations also document where water quality and beneficial uses are affected by roads.

Not all streams on the Umpqua National Forest meet water quality standards. The Oregon Department of Environmental Quality, using data collected by the Forest and others, designates specific streams on its list of Water Quality Limited Waterbodies (section 303d of the federal Clean Water Act) where standards are not met and beneficial uses are not protected.

During the spring and summer, most named streams on the Umpqua National Forest (except spring-dominated rivers in the High Cascades) are warmer than the Oregon water quality standard for temperature. In some watershed analyses, the Forest documented observations or measurements of fine sediment in spawning gravels or aquatic insects that are tolerant of sediment deposition. Streams like Steamboat and Canton Creeks, Little River and Cavitt Creek, Jackson and Beaver Creeks and the South Umpqua River do not meet water quality standards for sediment.

Some reaches of Steamboat Creek, Little River and Cavitt Creek, the South Umpqua River and Jackson Creek, the North Umpqua above Toketee, and Lemolo and Diamond Lakes do not meet the pH standard. Dissolved Oxygen standards are not met on some reaches of Steamboat, Big Bend and Fish Creeks, and the North Umpqua below Fish Creek and above Toketee. On some Forest streams fish habitat has been modified by removal of large wood.

Water Quality Management Plans (WQMPs) specify measures to protect and improve these streams. Any activities that could affect stream temperature, sediment, pH, dissolved oxygen or fish habitat must include these measures, so it's important to include them in all project plans. Map F-2 shows stream reaches that don't meet water quality standards. A complete list of water quality limited stream reaches is available on the Oregon Department of Environmental Quality web site:

http://www.deq.state.or.us/wq/303dlist/303dpage.htm

For example, Elk Creek on the Tiller Ranger District from its mouth at Tiller to its headwaters (including all tributaries) does not meet water quality standards. The temperature of Elk Creek is warmer than 64 degrees F (17.8 degree C) during the summer rearing period for salmon and steelhead. Flow modification or water withdrawals cause the stream to go dry in the fall of some years at the stream gage near Drew.

Any project plans to maintain, improve or decommission roads should recognize violations of water quality standards. For example, plans for activities in the Elk Creek watershed should include the following:

1) The location of the project in the watershed, the water quality standards that aren't being met (summer rearing temperature and flow modification), and the location of

water quality violations (mouth to headwaters). Cite the Oregon Department of Environmental Quality 303(d) list that includes Elk Creek, and the date of the most recent list (1998).

2) A description of the proposed project activities, and measures that will protect water quality. For example, no trees or other shade will be cut, including trees that would fall in the future to provide stability to beds and banks. Water for construction will be trucked from sources with water rights, and no pumping from streams will occur.
3) A determination under the National Environmental Policy Act that there will be no significant direct, indirect or cumulative environmental effects of the project on water quality.
4) The status of any existing or proposed Total Maximum Daily Load (TMDL) determination and Water Quality Management Plan (WQMP) written for the impaired waterbody (water quality limited Elk Creek), and how the project complies with requirements of that plan.

The Oregon Department of Environmental Quality writes Total Maximum Daily Loads and WQMPs, and National Forests implement those plans. A TMDL determines the sources of pollutants or contributions to water quality violations, and the water quality plans assign responsibility to those in the watershed to correct them.

Current Situation

The watershed analyses provide information on specific water quality concerns in watersheds and sub-watersheds of the Umpqua National Forest. Project-level road analyses should consider these findings. Some highlights are listed in this section:

Steamboat Creek

The main stem of Steamboat Creek has high pH and low dissolved oxygen in summer. Warm water temperatures, low flow, and photosynthesis from algae attached the streambed together reduce the carbon dioxide (and raise pH) in the stream during the day, and lower dissolved oxygen at night. Road construction and maintenance practices that increase stream temperature, lower summer flow (like water withdrawals), and allow nitrogen fertilizer to reach streams will make water quality violations more frequent.

The Lower Steamboat watershed analysis also says that the aquatic habitat in reaches of Steamboat Creek and its tributaries Deep Creek, Cedar Creek, Steelhead Creek and Reynolds Creek have been profoundly affected by riparian roads. A water quality standard for habitat modification is violated when roads prevent trees from falling in streams washing down tributaries, or when roads are used to cut or remove trees from streams and riparian areas. Decisions that restore wood to streams and let streams meander in their floodplains can mitigate these damages.

Lemolo Reservoir and Diamond Lakes

The pH and algae conditions in these waterbodies violate water quality standards. Special measures must be taken to assure that nitrogen is not increased in the reservoir or lake, or their tributaries. Roadbank fertilizer should not be used, or measures taken to prevent runoff from reaching surface water.

Elk Creek

Elk Creek streamflow is often too low to measure in late summer. Low flow conditions in

other months contributes to high water temperature. Water withdrawals along Elk Creek completely use the available streamflow, and any further water use for National Forest roads must be avoided. Road watering and dust abatement water should be obtained from sources outside the watershed, where water is legally available.

Beaver and Jackson

The Jackson Creek watershed analysis documented high peak flows, pH conditions and fine sediment in Jackson Creek and its tributaries. Recommendations included removing roads in earthflow terrain, limiting harvest of riparian and upland vegetation, and removing valley-bottom roads like Forest Road 29 along Jackson Creek.

Cow Creek

Cow Creek and its tributaries (South Fork Cow, Applegate, and Dismal Creeks) are aggrading fine sediment. According to the watershed analysis, sediment filling pool and spawning gravels may be the most limiting factor to the aquatic ecosystem in watersheds dominated by granite and schist geology. Road maintenance and construction should use practices recommended in the Tiller Ranger District Granite/Schist Policy (Umpqua National Forest, 1995). Road practices in Cow Creek should prevent landslides and debris flows, surface erosion from cutbanks, and delivery of sediment to stream channels.

Road stream crossings restrict passage of fish and other aquatic life AQ(10)

See separate: (link to)

Map F-2 "Water Quality Limited Clean Water Act Section 303(d) Waterbodies on the Umpqua National Forest"

Reference: See separate (link to)

Attachment F-4 "Fish Passage at Road Crossings Assessment Umpqua National Forest FY 2001"

Excerpt from: Umpqua National Forest Fish Passage at Road Crossings Assessment FY 2001

RESULTS

The majority of culverts (88%) in the fifteen 5th field watersheds surveyed rated out in the red category (Table 5). Most of these pipes are circular or squashed pipe-arches, which occur in headwater tributaries (Table 5). Because most culvert barriers are in the steeper headwater streams, very few coho and no spring chinook streams have been impacted. In fact, only about 12 out of 144 red culverts on the Forest have affected streams where coho occur or are nearby. However, this number is somewhat misleading because it is based upon a truncated coho distribution, which is greatly reduced from historic levels. If larger escapements occurred perhaps coho would move further into watersheds and encounter more culvert barriers.

The number of miles of habitat by species and life history that is currently accessible and blocked by culverts are displayed in Tables 6 to 8. The majority of culverts have impacted anadromous cutthroat and steelhead, and resident trout. All 144 red culverts (plus 1 ford) do not pass anadromous or resident juveniles or resident adults. These impediments represent approximately 8 % of the juvenile and 2 % of the adult steelhead miles and 3 % of the juvenile/adult coho miles on the Forest. For Oregon Coast cutthroat, 8 % and Upper Willamette Cutthroat 11 % of the miles on the Forest are blocked. For rainbow trout, 15 % of the miles on the Forest are blocked.

Top 5 Sites

#1 Williams Creek – This culvert is a partial barrier to adults at low flows and does not pass juveniles upstream. Williams Creek is used by steelhead and cutthroat trout, and coho salmon. It has some of the best remaining habitat in the Middle North Umpqua 5th field. If the culvert were corrected, an additional 4.37 miles of habitat would be made accessible. A potential challenge is that the culvert is under Highway 138 and would require major construction to correct passage. A bottomless arch or bridge would be the best solution.

#2 Cedar Creek (Rd 3821 MP 3.1) – Cedar Creek has been the focus of most Forest restoration in the past 5 years. Projects completed have decommissioned 5.3 miles of road and placed wood along 6 miles of stream. Correcting fish passage problems would continue this restorative effort. Replacement of this culvert would provide approximately 0.71 miles of habitat for cutthroat and steelhead trout. At this time the watershed and road analysis have

recommended that the 3821 road be decommissioned. However, no decision has been made to date because decommissioning would remove one of the last main roads in the subwatershed.

#3 Cedar Creek (Rd 3821 MP 2.6) – Replacement of this culvert would provide approximately .45 miles of habitat for cutthroat and steelhead trout.

#4 Emerson Creek – Emerson Creek is located in the Upper South Umpqua fifth field, a Tier 1 Key watershed. Emerson Creek provides habitat for OC cutthroat and OC steelhead, but the culvert located on the 2823 road limits access to the majority of the drainage. Replacement of this culvert would provide approximately 1.59 miles of habitat.

 # 5 Pinnacle Creek – Pinnacle Creek is a tributary To Boulder Creek in Middle South Umpqua, a Tier 1 Key watershed. It provides habitat for OC cutthroat and has potential to provide habitat for coho and OC steelhead. A large drainage area would be accessible if this culvert were replaced. Replacement of this culvert would provide approximately 1.2 miles of habitat.

Remaining Priority Sites

Cedar Creek (Rd 3821 MP 5.2) – Replacement of this culvert would provide approximately 0.15 miles of habitat for cutthroat and steelhead trout.

Black Canyon – Black Canyon Creek is a tributary of Jackson Creek, a Tier 1 Key watershed. It provides habitat for OC cutthroat and OC steelhead. A large drainage area would be accessible if this culvert were replaced. Replacement of this culvert would provide approximately 1.0 miles of habitat.

Crooked Creek – Crooked Creek is tributary of Jackson Creek, a Tier 1 Key watershed. It provides habitat for OC cutthroat and OC steelhead. A large drainage area would be accessible if this culvert were replaced. The Jackson Creek watershed analysis identified this stream as a high potential for migratory cutthroat. Replacement of this culvert would provide approximately 1.6 miles of habitat.

Attachment F-1

Use and Application of the SHALSTAB digital terrain model

SHALSTAB is a mechanistic, grid-based digital terrain model that can be utilized as a management tool for landscape level slope stability analysis. It is designed to delineate preferred sites of slope failure, specifically for shallow-rapid landslides in a steep, well-dissected landscape. An advanced version of SHALSTAB termed SHALSTABco can be used to assess shallow-rapid landslide potential for project-level slope stability analysis on the Umpqua National Forest. This recent version allows calibration of soil property values in the model. SHALSTAB is a product of a collaborative effort between the Department of Geology and Geophysics (renamed Earth and Planetary Science), University of California (Berkeley) and Stillwater Sciences, Inc., Berkeley, California. SHALSTAB was developed by Bill Dietrich, a researcher in the field of fluvial geomorphology who currently teaches at the UC Berkeley[F-11].

SHALSTAB theory is based on the observation that shallow rapid landslides tend to occur primarily within topographic hollows (swales), sites of steep concave slope form located between the ridge crest and the initiation point of first-order stream channels. During high intensity rainfall events shallow subsurface flow converges within topographic hollows that lead to increased soil saturation. As soil pore pressures increase soil shear strength is reduced. SHALSTAB links a steady-state, shallow subsurface flow model with a cohesionless infinite plane slope stability model to estimate the relative potential for shallow landsliding across a dissected landscape[F-12].

Steep topographic hollows are perceived to gradually fill with coarse-textured sediment transported under the influence of gravity from adjacent convex slopes by a variety of surface erosion mechanisms. Since the sediment residing in topographic hollows is gravity transported, these landforms are also referred to as colluvium-filled swales. The recurrence interval for slope failure within an individual colluvium-filled swale is thought to be on the order of a few centuries possibly ranging up to several thousand years. A debris avalanche that initiates from a colluvial swale can attain sufficient fluidity and momentum under exceptionally large storm events and ground conditions to propagate into a much larger and more devastating channel scouring debris flow[F-13].

[F-11] Stillwater Ecosystem, Watershed & Riverine Sciences, Inc. 2000. Landslides and Land Use Management – Validation and application of a digital terrain model for assessing and mitigating shallow landslide hazards.

[F-12] Dietrich, William E. and David R. Montgomery. 1998. SHALSTAB, A digital terrain model for mapping shallow landslide potential. Technical Report, National Council of the Paper Industry for Air and Stream Improvement: Corvallis, Oregon.

[F-13] Swanson, Frederick J., Lee E. Benda, Stanley H. Duncan, Gordon E. Grant, Walter E. Megahan, Leslie M. Reid, and Robert R. Ziemer. 1987. *In:* Salo, E.O. and T.W. Cundy

The SHALSTABco digital terrain model integrates slope gradient and slope convexity with soil parameters that include internal friction angle, saturated bulk density, and cohesion to delineate potential sites of slope instability. Slope gradient and slope convexity are obtained from the digital elevation model based on 10-meter resolution topographic data. The soil property values can be independently calibrated to simulate soil conditions for a specific landscape[F-14].

The SHALSTAB digital terrain model displays seven relative risk categories for slope stability ranging from 'chronically unstable' to 'stable' based on a logarithmic equation that integrates varies soil parameters and slope form characteristics pertaining to steepness and degree of convexity. This equation derives a range a positive and negative logarithmic (q/T) values that model a continuum of slope stability conditions. Logarithmic values more negative than -3.1 are inclusive of 'chronically unstable' and 'high potential instability' categories that have a strong tendency for slope failure[F-15].

SHALSTABco Risk Categories	Logarithmic q/T value
Chronically unstable	< -9.9
High potential instability	-9.9 to –3.1
Moderate-high potential instability	-3.1 to -2.8
Moderate potential instability	-2.8 to -2.5
Low-moderate potential instability	-2.5 to –2.2
Low potential instability	-2.2 to 9.8
Stable	> 9.8

As with earlier versions of the SHALSTAB digital terrain model, the SHALSTABco version contains simplifying assumptions regarding the landscape such as uniform soil depth of 1.0 meter regardless of slope gradient, and uniform rainfall intensity over the entire landscape regardless of aspect or elevation. Perhaps the most significant weakness of the SHALSTAB

(Eds.). Streamside Management – Forestry and Fishery Interactions, Contract No. 57, Institute of Forestry Resources, University of Washington: Seattle, Washington, 9-38.

[F-14] Dietrich, William E. and David R. Montgomery. 1998. SHALSTAB, A digital terrain model for mapping shallow landslide potential. Technical Report, National Council of the Paper Industry for Air and Stream Improvement: Corvallis, Oregon.

[F-15] Dietrich, William E. and David R. Montgomery. 1998.

digital terrain model is that its accuracy is largely driven by the resolution of input topographic data – the digital terrain model that it is linked to. The slope stability analysis for the Umpqua National Forest is based on relatively refined 10-meter pixels, a derivative of the ground topography portrayed on USGS topographic sheets. The contour spacing portrayed on current USGS topographic maps (and their derivative 10-meter pixel digital versions) do not provide sufficient detail or accuracy to effectively delineate most of the smaller topographic hollows and swales that are present in a steep well-dissected landscape. The model does effectively delineate broad headwalls that contain several swales or larger well-defined swales[F-16].

For any given storm event or limited observational period it is expected that only a fraction of those sites with q/T values equal to or below the threshold value of q/T <-3.1 will experience a landslide. Those sites that have appropriately low q/T values indicative of inherent slope failure, but do not exhibit evidence (field signatures) of recent failure, have different local conditions or parameters than those input into the SHALSTAB model, such as a higher friction angle, greater cohesion, reduced soil permeability, or a different subsurface flow field than predicted[F-17].

The SHALSTABco digital terrain model is strictly intended for predicting the spatial distribution of relatively small shallow-rapid type landslides, and not for predicting large, deep-seated mass movement features such as bedrock failures, rotational slumps and earth flows. Landscapes for which the SHALSTABco digital terrain model is not expected to perform well include terrain dominated by deep-seated landslides or areas of massive rock outcroppings (cliffs and bluffs), or areas with deep groundwater flow and locally emergent springs and seeps. The SHALSTABco digital terrain model requires a well-defined soil-bedrock boundary (interface) and not a soft, clay-rich saprolitic zone that can develop on some of the deeply weathered volcanic lithologies that underlie gently sloping and weakly dissected terrain[F-18].

Tree roots are thought to stabilize slopes by providing a laterally reinforcing layer that acts as a membrane to hold the underlying soil in place. Tree roots also serve to anchor an unstable soil mantle to fractured rock substrate. In the later case the roots penetrate downward through a potential failure plane that typically occurs at the interface between the soil mantle and underlying bedrock. Tree roots can be thought of as supplemental cohesion within the soil mass[F-19].

[F-16] Dietrich, William E. and David R. Montgomery. 1998. SHALSTAB, A digital terrain model for mapping shallow landslide potential. Technical Report, National Council of the Paper Industry for Air and Stream Improvement: Corvallis, Oregon.

[F-17] Stillwater Ecosystem, Watershed & Riverine Sciences, Inc. 2000. Landslides and Land Use Management – Validation and application of a digital terrain model for assessing and mitigating shallow landslide hazards.

[F-18] Stillwater Ecosystem, Watershed & Riverine Sciences, Inc. 2000.

[F-19] Denning, Cliff. 1994. Root strength and Tree Surcharge (Section 4F). *In:* Hall, David E., Michael T. Long, and Michael D. Remboldt (Eds.). Slope Stability Reference Guide for National Forests in the United States. U.S. Dept. of Agriculture, Forest Service, Engineering Staff: Washington, DC, EM-7170-14, V II, 543-548.

After regenerative timber harvest or severe wildfire, tree roots begin to decay and the tensile (elastic) strength provided by root fibers begins to decrease. The period of minimum tree root reinforcement based on field studies and research has been shown to extend from a period of roughly 3-5 years following harvest or wildfire to 10-20 years afterwards, depending upon the degree of vegetative re-growth. In areas that are severely burned following wildfire, minimum root strength may occur within the first 3-year period. After about 10 to 20 years post-harvest, tree root reinforcement will increase to its prior uncut level if sufficient vegetative re-growth has occurred. During the period of minimum strength, tree root reinforcement could conceptually be 20 to 40 percent of its undisturbed value[F-20].

Soil property values input into the SHALSTABco digital terrain model for the Umpqua National Forest are calibrated based on landslide occurrence determined from aerial photo interpretation of the Upper South Umpqua watershed. The SHALSTABco version is integrated with tree mortality in the wake of the 2002 wildfire season and thus incorporates areas where loss of tree root reinforcement is a factor in slope stability.

The SHALSTABco version contained in the Geographical Information System (ArcView) only displays 'chronically unstable' and "high potential instability" categories as a single identity. Red pixels in this identity denote areas where tree root reinforcement is greatly diminished, while green pixels depict areas where the tree canopy remains intact. The five remaining risk categories in SHALSTABco are grouped into a second identity and represent areas of decreasing risk of slope instability.

[F-20] Denning, Cliff. 1994. Root strength and Tree Surcharge (Section 4F). *In:* Hall, David E., Michael T. Long, and Michael D. Remboldt (Eds.). Slope Stability Reference Guide for National Forests in the United States. U.S. Dept. of Agriculture, Forest Service, Engineering Staff: Washington, DC, EM-7170-14, V II, 543-548.

Attachment F-2

1995 Tiller RD Operating Policy in Areas of Granitic and Schistose Soils

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I. ROAD CONSTRUCTION

Road construction practices for both temporary and system roads need to involve current design and construction guidelines, with a few additional practices. Road construction in granitic soil will be more expensive than in more stable materials.

Temporary roads need to have interdisciplinary team input to assist in location and design when working in granitic soils. ID team specialists should include a geologist, soil scientist or geotechnical engineer, and a hydrologist. Slopes over 45% need special consideration.

Temporary roads need to have drainage and storm proofing. Temporary roads will be considered for decommissioning, at the completion of the project.

1. Location
   a) Use rolling grades whenever possible to avoid over-steeped areas. Minimize road grades when possible to reduce the amount of erosion.
   b) Use ridge top locations whenever possible.
   c) Do not locate roads through over-steepened headwalls.
2. Design and Drainage
   a) On maintenance level 2 or 3 roads where fresh fill slopes occur, in-slope roads. Out-slope roads in areas where water will drain onto stable, vegetated slopes.
   b) Out-slope temporary roads and roads designated as Maintenance Level 1.
   c) Line ditches with rock or other materials to prevent scour. Other ditch lining materials may include concrete, geotextiles fabrics, asphalt, etc.
   d) User risers on culvert inlets to prevent plugging. Risers may be slotted, beveled, crescent shaped or other designs, as appropriate.
   e) Use rock armor, geotextiles, or other stabilizers on back slopes of high catch basins. The use of geotextiles and other stabilizers may require special designs that will need to be provided by specialists.
   f) Design escape routes so that water from a blocked culvert cannot run along long sections of road. Levels 1, 2, and 3 escape routes can be rolling dips or other appropriate structures. Structures should be placed no more than 150 apart. The placement of these structures is dependent on the grade of the road and slope of the ground.
   g) Use close drainage spacing (culverts or dips) in areas of granitic soil. Consider adding additional drains to reduce 'stream channel extension' by the road system.
   h) Align drains with natural channels, when possible.

i) Attempt to design drainage structures so that water is spread out evenly over a slope, instead of concentrated in small areas. Drain into vegetated areas when possible.

j) Avoid disrupting the vegetation layer near drainage structures.

k) Use full, round downspouts if culvert outlets cannot be located at a natural ground surface.

(1) Do not construct culvert outlets on a fill slope.

(2) Dissipate flow energy at ends of downspouts using riprap, geotextiles, or stumps.

l) Use energy dissipaters on drain dips or waters bars when located on fill material, such as geotextiles, rip rap, stumps, slash, or straw bales.

m) Do not drain water into headwall areas.

n) Space water bar structures at close intervals (15 ft. elevation change or less).

(1) Hydrologists, engineers, soil scientists, or timber sale administrators should flag the location (placement and proper spacing) of water bars.

(2) Water bars should be angled at 45 degrees, open-ended, free to drain, and constructed in a manner to be effective even if partly filled by silt.

(3) Control discharge by utilizing natural vegetation or hand placed energy dissipaters such as straw bales, slash, logs, rocks, or a combination.

o) Use full bench construction with end-haul on side slopes over 40%.

p) Consider getting Geotechnical assistance on cut slopes higher than 10 feet and in unstable zones.

(1) Adjust cut slope ratios to fit the site conditions. In general:

(a) Use 1.5 to 1 cut slopes on slopes less than 30%.

(b) Use ¾ to 1 cut slopes on slopes greater than 30%.

(c) Cut slopes of ¼ to 1 may be considered if Geotechnical consultants indicate that the material is sufficiently stable.

(d) Consider benching, rock blankets or other techniques on cut slopes greater than 10 ft. height.

3. Surfacing

a) Use stabilized surfacing on all system roads in areas of granitic soil.

(1) Surfacing must be installed prior to the winter season.

(2) Use stabilized surfaces on all temporary roads that will not be decommissioned prior to the winter season.

(3) Stabilizing surfacing materials can consist of crushed rock aggregate, asphalt, erosion control fabrics, heavy mulches, etc.

b) When using serpentine as aggregate, use two-inch or larger material size material.

c) Consider paving roads located adjacent to streams.

4. Erosion Control Measures

   a) Maintain existing vegetation whenever possible.

   b) Place rock berms along the outside edge of in-sloped roads to prevent water running onto fill slopes.

      (1) Remove berms when slope has been stabilized with vegetation. When possible, remove berms on the next entry.

      (2) When changing a road from in-slope to out-slope, ensure that the aggregate surfacing is not lost.

      (3) If the surfacing cannot be retained, add additional crushed rock to protect the outside shoulders.

      (4) Consider out-sloping roads after removal of berms. Consider using K-V funds for removal of berms, if project has been completed.

   c) Line lead-in ditches with rock, asphalt or other liners.

   d) Require slash pullback on fill slopes whenever possible.

   e) Apply seed and mulch to exposed soils on cut and fill slopes. When possible, use native vegetation.

      (1) Re-mulch or re-fertilize the second and fourth years after initial application. Consider using K-V funds if the project is completed.

      (2) Apply follow-up seed and mulch as needed. Consider K-V funds if follow-up seeding is anticipated and the project will be complete.

      (3) Include ponderosa pine, knob cone pine, Jeffery pine, and incense cedar on fill slopes. Consider native alder, willow, etc., in areas with higher soil moisture.

      (4) When available, use native plants in seed mixes, such as:

         (a) Vetch (Vicia Americana)

         (b) Leafy Pea (Lathyrus Polyphyllus)

         (c) Wild Blue Rye (Elmyus Glacus)

         (d) Western Fescue (Festuca Occidentalis)

         (e) Squirrel Tail (sitanion Hystrix)

5) Road Use

   a) Close and storm-proof temporary roads at the end of each working season, if they are to be used for more than one season.

   b) Consider closing and storm-proofing system maintenance level 1 roads at the end of each season, if they are used for more than one season.

   c) If a temporary road cannot be decommissioned prior to the winter season, the surface should be stabilized and all drainage structures storm-proofed.

   d) If it is desired that a temporary road not be decommissioned, consider adding the road to the Forest Road System.

e) Consider winter closures for all roads where the surface or drainage structures would be damaged by vehicles.

II. ROAD MAINTENANCE

Increased levels of road maintenance must be expected in granitic soils, even with the recommended construction techniques. Granitic soils tend to have poorer vegetation recovery and show continued long-term tendency to ravel. Even with reduced maintenance funding, additional effort is required in granitic soils to minimize sediment production.

1. Maintenance Guidelines
   a) Improved road surfacing and cut slope vegetation reduces the frequency of needed maintenance.
   b) Appraise for the use of a backhoe or excavator for purchaser-required maintenance.
   c) Road maintenance should not remove the dry ravel collected along ditch lines. This ravel is constructing a stabilized cut slope based on its natural angle of repose, and is a good surface for grass and other vegetation to take hold upon. Over a period of year, the ditch line can gradually be moved out, especially after berms have been removed from the shoulder. Ditch line ravel and small cut slope failures that interfere with drainage should be removed.
   d) Storm-proof, decommission, and/or close roads that cannot be adequately maintained.

III. ROAD DECOMMISSIONING

The goal of decommissioning is to reduce the potential for erosion and sedimentation and allow the area to return to a productive state. Utilize geotechnical, earth and natural science specialists when developing specific criteria for each road.

1. Remove all stream crossing culverts not designed for a 100-year flood event. Consider removing all stream crossing culverts after road decommissioning.
   a) Reconstruct stream channels to the grade of the original stream channel.
   b) Remove excess fill material at sites of removed culverts to prevent down slope migration of sediment into the stream channel.
   c) Armor stream channels to prevent down cutting into poorly consolidated soils.
2. Consider pulling back any oversteepened fill slope that is not re-vegetated.
3. Roll grades and/or install water bars on a 50-foot maximum spacing.
   a) Drain surface runoff into vegetated areas or utilize straw bales or other silt fencing at the outlets of water bars.
   b) Out-slope road surface when possible.
   c) Alter grades and slopes so that in the event of a failure, damage will be localized and will not extend over a long section of the old road.

d) Remove ditches, unless required by special circumstances.

4. Treat cut slopes to prevent erosion.
   a) Consult with geotechnical specialists on cut slope recommendations.
   b) Cut slope remediation may include benching, adjusting slopes, geotextiles, rock blankets, heavy mulches, silt fencing, or other measures.
5. Treat the road surface to reduce compaction, minimize sedimentation, and improve chances of re-vegetation.

IV. LOGGING SYSTEMS

The objective in all logging systems is to minimize the amount of soil and vegetation disturbance. Do not log granitic slopes steeper than 60% unless approved by a technical specialist, such as a hydrologist, soil scientist, geologist, or geotechnical engineer.

1. Low Ground Pressure Tractor
   a) Use skyline or multi-span type logging systems where deflection permits.
   b) Loader logging is preferred over tractor logging because of lower levels of soil compaction and displacement.
   c) Designate skid trails in advance.
      (1) Limit the number of skid trails with the objective of limiting displacement to less than 20% of the area.
      (2) Locate skid trails in locations where proper drainage can be installed.
      (3) Locate skid trails in areas where they will not need to be excavated.
   d) Require winching up to 50 ft.
   e) Require one-end suspension with integral arch on tractors.
   f) Do not allow tractors to spin around any more than necessary and displace soil with the tracks.
   g) In most cases, skidders or tractors should be used on slopes less than 25%, with 30% slope maximum.
2. Skyline or multi-span Logging Guidelines
   a) Logging systems should be designed to obtain at least one-end suspension. Full suspension should be required, when possible.
   b) Analyze whether lateral yarding or additional skyline roads would have the least impact.
   c) Skyline landings should be incorporated into the road design and appraised logging cost under C6.422.
      (1) The road prism can sometimes be used for a landing, but the need for a designated landing should always be reviewed.
      (2) Landings should have drainage designed with the same standards used for roads.

(3) Pull back debris and soil that is pushed out on landing edges during use, prior to completion of the timber sale.

d) Specify tower height needed to obtain the required deflection.

e) Consider use of Multispan skyline to reduce the number of roads.

f) Ensure that the type of logging equipment specified can be transported on the road system. The yarder is usually the critical vehicle.

3. Other Logging System Guidelines

a) Aerial systems (helicopter, balloon) should be considered when other systems are likely to impair resource values.

b) Consider aerial systems for uneven-aged management or overstory removal.

4. Logging System Preferences

The following logging systems are listed in order of most desirable to least desirable in regards to minimizing damage to soil and vegetation resources:

(a) Aerial (helicopter, balloon)

(b) Skyline – full suspension

(c) Multispan

(d) Skyline – one-end suspension

(e) Loader Logging

(f) Low ground pressure tractor – one-end suspension

(g) Horse – when combined with Loader Logging and reviewed by Earth Science specialists

Logging systems not acceptable:

(a) Highlead

(b) Tractor without one-end suspension

5. Operations Timing

Recommended normal operating season in granitic soils in June 1 to October 31.

V. FELLING PRACTICES

Directional felling techniques are helpful for protecting stream banks and streamside vegetation, headwall and unstable areas.

1. Guidelines for Directional Felling Along Streams.

a) Directional felling should be required for stream bank and streamside vegetation protection on all classes of streams in areas of granitic soil.

b) Directional felling should be required to protect riparian buffers.

2. Guidelines for Directional Felling on Headwalls

a) Directional felling should be used to fall trees away from headwalls and headwall

buffers in order to prevent soil disturbance and protect the vegetation on headwalls.

VI. SLASH DISPOSAL

1. Hand pile slash, as use of heavy equipment will disrupt soil.
2. If a silvicultural prescription recommends broadcast burning, then prescribed fire should be designed to minimize damage to the duff layer to mitigate the potential increase in sedimentation.

VII. SILVICULTURAL PRESCRIPTIONS

1. No timber harvest on oversteepened granitic slopes (slopes greater than 60%), unless the site have been reviewed and approved by a technical specialist such as a hydrologist, geologist, geotechnical engineer, or soil scientist. Thinning may be appropriate on steep slopes, but will need specialist review and approval.
2. Buffer oversteepened headwall areas, at least 50 feet beyond the edge of the headwall area.
3. Include incense cedar, knob cone, Jeffery and/or ponderosa pine for vegetative recovery, where slope stability is a concern.
4. Thinning or partial cutting only on slopes over 40%.

VIII. DEFINITIONS

1. **Earth Science Specialist** – A professional level person trained in the field of geology, geotechnical engineering, soil science, or hydrology.
2. **Granitic** – A geologic term that describes an igneous rock that has a mineralogic composition similar to granite. Granite is a speckled, light-colored intrusive rock that has large discrete (visible) mineral grains composed primarily of silica (quartz), feldspar, and varying amounts of dark-colored iron- and magnesium-rich minerals, including biotitic and/or hornblende. These constituent minerals chemically and mechanically weather (decompose and detach readily) forming a coarse grained, granular, non-plastic soil known as gruss. Most soils derived from granitic bedrock in steep, well-dissected terrain is considered to be highly erosive. Granitic bedrock is depicted by the symbol (KJg) on the State Geologic Map.
3. **Schistose** – A geologic term that describes a medium- to coarse-grained metamorphic rock that has a laminated and flaky textural appearance. Schist is largely composed of quartz (silica), mica (biotite or muscovite), and other iron- and magnesium-rich minerals, such as chlorite, hornblende, or actinolite. Schist has a laminated or foliated texture, meaning that the constituent mineral grains in the rock display a conspicuous platy or linear alignment due to recrystallization at depth in the Earth under elevated heat and pressure (directed stress) gradients. Schist composed predominantly of platy mineral grains (mica or chlorite) has an inherent susceptibility to surface erosion due to its light unit weight and buoyancy that facilitates it transport in water. Schistose bedrock is depicted by the symbol (mc) on the State Geologic Map. The map attribute (mc) refers to

the May Creek terrane within the Klamath Mountains province.

4. **Headwall** – A very steep, concave slope form that develops by the combined process of mass wasting and fluvial erosion in a regional uplifting landscape over geologic timeframes. Headwalls lie between ridge crests and the initiation point of a stream channel and are a characteristic of well-dissected landscapes. Headwalls are preferred sites for the initiation of rapid-moving, shallow-seated type landslides.
5. **Stream network extension** – A hydrologic effect attributed to roads where sediment supply and intercepted groundwater is directed by ditch lines directly into stream channels. Ditches therefore are considered to be an extension of the stream network and according to current studies may possibly cause an increase in the volume and timing of peak flows within stream channels.
6. **Storm proofing** - A term used in road restoration that describes methods for minimizing the potential for erosion on a road. Examples of storm proofing may entail the following: (1) reconstructing a road stream crossing in a manner that prevents the stream from diverting out of its channel or and down the road, or (2) pullback of fill that has a high potential for slope failure.

Attachment F-3

Umpqua National Forest

Spill Prevention and Response Plan

INTRODUCTION

Frequently, large quantities of chemical materials are transported across Forest Service boundaries. Accidental spillage of this material can often have a detrimental effect on the Forest environment as well as on human life. The intent of Forest planning is to prevent spills when possible and provide limited "first aid" response until State (DEQ) and Federal (EPA) agencies can assume their responsibilities. The specific objectives of this plan are:

Help minimize the probability of accidental spills;

Make provisions for a rapid and safe response to any on-Forest spill incident; and

Provide for notification of appropriate authorities and the protection of the public.

IMPLEMENTATION OF THE PLAN

To minimize the probability of accidental spills:

The District Spill Coordinator will prepare a chemical safety plan for all projects using chemical materials in sufficient quantities to have detrimental effect on the Forest environment. This plan will include safety requirements and provide for contingency action in the event of an accident.

To provide for a rapid and safe response to any accidental spill on or threatening National Forest lands.

The District Coordinator will assure that proper supplies and procedures are available on the District level.

The Coordinators will provide training in spill response techniques including containment and clean up of contaminated materials.

The Coordinator will provide for notification of appropriate authorities and the protection of the public.

The Coordinator will provide appropriate spill response, depending on who spilled hazardous materials and where spilled. Whenever local DEQ coordinators arrive, they shall assume authority for directing spill response and determining responsibility for the spill.

OUTLINE OF RESPONSIBILITIES

All field personnel:

Be prepared to respond to a spill situation in a safe and effective manner (see front cover).

Notify the Spill Coordinator of all spills.

Advise the Coordinator of any active projects involving potentially hazardous materials.

District Spill Coordinator:

Assure health and safety for all involved.

1) Provide appropriate spill response (see front cover).
2) Develop a chemical safety plan for all ongoing projects involving chemicals.
3) Assist with the training of personnel in spill prevention and response.
4) Report all spill events that occur on the District to District Ranger and Forest Coordinator.
5) Keep the spill cache supplies in a state of readiness.
6) Keep the District Spill Plan updated.

A. Forest Coordinators:

1) Provide technical and logistical support during a spill response.
2) Provide updated documentation for Forest Spill Plan.
3) Maintain an annual record of District spill reports.
4) Coordinate training in safety and accident response.
5) Coordinate emergency funding.

FUNDING AND SPILL RESPONSE

It is very important that Forest Service actions in the event of a spill comply with existing laws and yet do not go beyond that authorized under funding authority. Initial actions must protect Forestlands and resources, but not supplant those of responsible parties. Spills of concern to the Forest Service fall into one of three categories below:

A. **All spills resulting from Forest Service activities.** The appropriation or fund benefiting under law would finance the cost of complying with requirements.

B. **Spills threatening National Forest lands or resources resulting from other than Forest Service activities where the spiller can be identified.** In these cases, the spiller is responsible for costs incurred. Every effort shall be taken to encourage the entity responsible for the spill to take appropriate action to contain the spill in a timely manner. If the entity cannot or will not take effective action to prevent further contamination and cleanup, that fact should be well documented and the entity will be billed either through the U.S. Coast Guard (oil spills) or EPA Superfund (chemical spills). This action must be coordinated with the USCG or EPA Regional On-Scene-Coordinator (OSC). The OSC locally is the DEQ representative. Once such action is approved by the OSC, cleanup may proceed as in Category A except that every action taken, including costs, must be documented and the OSC must be kept current on all actions taken. [See Item D below.]

C. **Spills threatening National Forest lands or resources where the spiller cannot be identified.** In these cases, a thorough attempt to identify the entity responsible for the spill should be made. If the spill is threatening to contaminate streams or to damage other Forest resources, the necessary containment actions should be taken while the

attempt to identify the entity is being conducted. Costs and actions should be documented as outlined below (procedures for using revolving fund).

If identification of the responsible party is determined, they should be notified in writing of the spill and of the costs incurred and should be encouraged to continue with the cleanup. If the entity either will not or cannot accomplish the cleanup, proceed as in (B) above.

D. Procedures to follow in the use of Pollution Revolving Fund established under the

Federal Water Quality Control Act amendments of 1972 and Superfund are explained in Annex VIII-1800, Documentation for Enforcement and Cost Recovery from Oil and Hazardous Substances Pollution Contingency Plan for Standard Federal Region 10. (See consultation with environmental agency coordinators below.)

- The USCG Revolving Fund (Oil Fund) can only be used for reimbursement of cost incurred for spills of oil as defined in Section 311(a)(1) of the Federal Water Pollution Control Act.
- The "Comprehensive Environmental, Response, Compensation, and Liability Act of 1980" (CERCLA) "Superfund" provides certain funds for use in removing hazardous materials from the environment that may threaten the general public. Request for these funds must be coordinated through U.S. Environmental Protection Agency On-The-Scene Coordinator (EPA OSC). In Oregon, EPA will designate local Department of Environmental Quality (DEQ) representatives as the OSC.
- Direct oil fund requests to the RO Coordinator to the U.S. Coast Guard, through the EPA-designated On-The-Scene Coordinator (DEQ). The purpose of the fund is for containment, cleanup, and disposal operations when the spiller is unknown, does not act promptly, or does not propose to take appropriate and sufficient action.
- Authorization to use the oil fund comes from the U.S. Coast Guard District Commander or the designated representative. The Commander or representative must determine whether the pollution incident meets the criteria specified in the Act. Requests for reimbursement through the oil fund must be made by the RO through the EPA Seattle, Washington, at 206-422-1263 (24 hours). The Coast Guard shall give a specific project number and amount of authorized commitment based on an initial estimate.
- Charges shall be made to reimbursable account (Account #) - 312-01- (Submit #) – (Project # assigned by USCG).
- Allowable charges to the oil fund are listed in the R-10 Contingency Plan Annex VIII.
- Superfund charges are less restrictive, though directions for their use have not been printed. Use of this fund will be coordinated with the EPA-OCS (DEQ) through the RO Coordinator.

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