

Appendix D: Best Management Practices

Best Management Practices (BMPs) were developed to comply with Section 208 of the Clean Water Act. BMPs have been certified by the State Water Quality Resources Control Board and approved by the Environmental Protection Agency (EPA) as the most effective way of protecting water quality from impacts stemming from non-point sources of pollution. These practices have been applied to forest activities and have been found to be effective in protecting water quality within the Klamath National Forest (Forest). Specifically, effective application of the Region 5 Forest Service BMPs has been found to maintain water quality that is in conformance with the Water Quality Objectives in the North Coast Regional Water Quality Control Board's Basin Plan (http://www.waterboards.ca.gov/northcoast/water_issues/programs/basin_plan/).

Region 5 Forest Service BMPs have been monitored and modified since their original implementation in 1979 to make them more effective. Numerous on-site evaluations by the North Coast Region Water Quality Control Board have found the practices to be effective in maintaining water quality and protecting beneficial uses.

The Forest monitors the implementation and effectiveness of BMPs on randomly selected projects each year. From 2000 to 2012, BMP implementation requirements were met on 78-100 percent (91 percent average) of sites sampled, and BMP effectiveness requirements were met on 88-100 percent (94 percent average) of the sites sampled (USDA Forest Service, 2013c). The critical BMP evaluation is *effectiveness* which is a field evaluation to determine how well the BMP worked to prevent sedimentation. The success rate for effectiveness has been in the high 80s and 90s each year since 1993.

Best Management Practices first identified and utilized by the Klamath National Forest are listed in appendix D of the Forest Plan. These basic BMPs have been revised over the years, and are currently similar to those listed in the 2012 Region 5 BMP update in Chapter 10 of the Soil and Water Conservation Handbook, which additionally includes a narrative and objective of each (USDA USFS 2011); and where there are differences, direction is to employ the newer BMP list. The following 'on-the-ground' prescriptions below are incorporated into the project (see chapter 2 of draft EIS).

BMP 1.1 – Timber Sale Planning Process:

Requires the Interdisciplinary Team (interdisciplinary team) to consider methods of reducing water quality impacts during the planning phase of a project. This is accomplished during the planning process of the Timber Sale project.

- An interdisciplinary team review was completed and project design features have been incorporated into the project design (See Chapter 2 of the EIS).

BMP 1.2 – Timber Harvest Unit Design:

Requires the interdisciplinary team to consider methods of reducing water quality impacts due to changes in unit design. This is accomplished during the planning phase of a project. Examples of design changes are restricting timing of tree removal and utilizing less impacting yarding systems.

- An interdisciplinary team review was completed and project design features have been incorporated into the project design (See Chapter 2 of the EIS).

BMP 1.3 – Use of Erosion Hazard Rating for Unit Design:

Identifies high or very high erosion hazard areas and adjust management activities to prevent downstream water quality impacts; and to increase soil cover for those areas that have a high risk of contributing sediment into streams. This is done during the planning and layout phase of the project.

- Based on field review and site data (percent slope distribution, soil texture), the Forest Soil Scientist determined the surface erosion hazard rating for each treatment unit and prescribed logging systems and soil cover needs based on the erosion hazard rating.

BMP 1.4 – Use of Sale Area Maps for Designating Water Quality Protection:

Identifies sensitive areas and water uses as part of the Timber Sale contract to assist operators in locating water concerns and applying protection methods. This is accomplished during contract preparation and implemented during layout of the sale.

- The Sale Area Map will include all protected stream-courses, unstable land features, springs, wetlands, meadows, water drafting sites, landings, temporary roads, and logging system for each unit.

BMP 1.5 – Limiting Operating Period of Timber Sale:

To prevent soil compaction and erosion from operations during wet weather; and to ensure placement of erosion control structures prior to the onset of winter to reduce water quality impacts. This is accomplished during the timber sale operations.

- The project is proposed to take place during the normal operating season (NOS) that is defined as May 1 to October 31. All ground disturbing activities, whether inside or outside of the NOS, will be implemented according to the Forest’s Wet Weather Operation Standards (Klamath National Forest, 2002).
- Areas where soil has been disturbed by project activities within Riparian Reserves must be stabilized prior to the end of the normal operating season, prior to sunset if the National Weather Service forecast is a “chance” (30 percent) of rain within the next 24 hours, or at the conclusion of the operations, whichever is sooner. This includes skid trails that cross swales (i.e. linear depressions perpendicular to the slope contour that do not meet definition for designation as a Riparian Reserve). Restoration generally consists of removing excess sediment, reshaping and waterbarring former approaches, and spreading slash on the former crossing.

BMP 1.6 – Protection of Unstable Lands:

Provides for special treatment of unstable areas to avoid triggering mass slope failure with resultant erosion and sedimentation.

- Tractors and mechanical harvesters will be excluded from all riparian reserves associated with stream channels, active landslides, inner gorges, and toe zones of dormant landslide deposits. In Roadside hazard tree units the equipment will be restricted to the road surface.

- To limit slope disturbance, inner gorge terrain (greater than 65 percent slope) that extends beyond Riparian Reserves will be buffered by 20-foot slope distance and excluded from mechanical equipment activities. In areas where treatments may conflict, a hydrologist will be consulted.
- There will be no salvage logging on active landslides except for units 5, 23, 32, 39, 55, 56, 57, 59, 64, 226, 268, 406, 520, 524, 525, and 530 which have been field reviewed by the Forest Geologist (see Geology amendment for details on criteria for exceptions).
- Limit equipment disturbance within 20 feet on either side of swales by minimizing equipment crossings and avoiding running trails up the axis of swales, except at designated crossings.

BMP 1.8 – Streamside Management Zone Designation:

Designates zones adjacent to water and/or riparian areas as zones of special management. This is accomplished during the planning and layout phase of the project.

- Project Riparian Reserves are established in the following manner per the Forest Plan (site tree for Salmon and Happy Camp districts is 170 feet, site tree for Scott and Oak Knoll districts is 150 feet):
- For fish-bearing streams, it is the area on each side of the stream extending from the edges of the active stream channel to the top of the inner gorge, or to the outer edges of the 100-year floodplain, or to a distance equal to the height of two site-potential trees, or 300 feet slope distance (600 feet total, including both sides of the stream), whichever is greatest. For Salmon and Happy Camp ranger districts, this will be 340 feet (680 feet total).
- For permanently flowing nonfish-bearing streams, it is the area on each side of the stream extending from the edges of the active stream channel to the top of the inner gorge, or to the outer edges of the 100-year floodplain, or to a distance equal to the height of one site-potential tree, or 150 feet slope distance (300 feet total, including both sides of the stream), whichever is greatest. For Salmon and Happy Camp ranger districts, this will be 170 feet (340 feet total) and 150 feet for the Oak Knoll and Scott River Ranger District.
- For intermittent streams, , the stream channel and extending to the top of the inner gorge, or extension from the edges of the stream channel to a distance equal to the height of one site potential tree, or 100 feet slope distance, whichever is greatest. For unstable lands, it is the extent of unstable and potentially unstable areas.
- Consistent with Forest Plan direction, Riparian Reserves for wetlands and springs will be defined by the edge of the feature out to a distance equal to 1 site potential tree. These RRs will be flagged and avoided during salvage harvest.

BMP 1.9 – Determining Tractor Loggable Ground:

Minimize erosion and sedimentation resulting from ground disturbance of tractor logging systems.

- In salvage units and subsequent site preparation, skidding equipment will be restricted to slopes less than 35 percent. Skid trails that connect benches in dormant landslide terrain can have minor portions of the skid trails on slopes

greater than 35 percent. Ground-based equipment can travel up to 100 feet on slopes 35 to 45 percent.

- Site preparation treatments would be designed to meet soils management direction in the KNF Forest Plan. This may include use of low ground pressure equipment, retaining slash and large woody material and implementing hand treatments instead of mechanical. Site preparation will be used to reduce fuels where the sum of one hour, ten hour, and 100 hour fuels exceeds 7 tons per acre.

BMP 1.10 – Tractor Skidding Design:

Designates a tractor skid pattern over steepened areas, designates tractor crossings, and reduces skid patterns in sensitive areas to reduce erosion and compaction. This is accomplished during the sale layout and operations phase of the project.

- In salvage units and subsequent site preparation, skidding equipment will be restricted to slopes less than 35 percent. Skid trails that connect benches in dormant landslide terrain can have minor portions of the skid trails on slopes greater than 35 percent.
- In site preparation units (where no salvage will occur) mastication, felling, and skidding equipment will be restricted to slopes less than 35% on granitic and schist soil types, and up to 45% on all other soil types. Site preparation treatments in Riparian Reserves will be by hand only.
- Use existing skid trails instead of building new skid trails unless using existing skid trails will have greater negative effects. Space skid trails at least 75 feet apart, except near landings and where trails converge. Use no skid trails in areas in which ground-based mechanical equipment is excluded (Designation of new skid trails will be approved by a Timber Sale Administrator. Erosion and sedimentation control structure will be maintained and repaired per the guidance in the Forest Service Handbook 2409.15 R5 Supplement.
- No full bench skid trails will be constructed. Full bench skid trails have the entire skid trail cut into the hillslope.
- Locations where skid trails intersect roads will be obliterated or effectively blocked to vehicle access.

BMP 1.11 – Suspended Log Yarding in Timber Harvesting:

Protect the soil mantle from excessive disturbance; maintain the integrity of the Streamside Management Zone and other sensitive watershed areas, and to control erosion on cable corridors.

- Skyline corridors will be placed on the landscape as to minimize disturbance to active landslides, inner gorges and toe zones of dormant landslide deposits. All skyline and ground-based yarding will require one-end suspension in corridors and on skid trails. Corridors for skyline yarding that are parallel to the stream channel will be placed outside of the Riparian Reserve. The corridor may cross the stream channel with full suspension of logs within ten feet from the stream bank. Apply erosion control measures as necessary in cable corridors to control erosion and runoff. This could include hand construction of water bars and /or spreading slash from adjacent areas.

BMP 1.12 – Log Landing Location:

Locate new landings or reuse existing landings in such a way as to avoid watershed impacts and associated water quality degradation.

- See BMP 2.4
- Existing landings will be used to the extent possible. New landings in stream-course Riparian Reserves will not involve removing stream shade over perennial stream channels. For the six new landings in Riparian Reserve approved for use in this project, Forest Service watershed specialists will be involved in site specific decisions related to vegetation removal, drainage and erosion control, and hydrologic stabilization. Existing landings in stream-course Riparian Reserves will not be expanded towards stream channels, or on to active landslides, or where vegetation that provides shade to a stream would need to be cut. Existing landings in Riparian Reserves will be shaped and treated for erosion control at the end of each season of use, and hydrologically restored at project completion (including subsoiling and covering with slash/mulch as needed). Reused landings in Riparian Reserves will have site specific erosion control measures to reduce risk of sediment delivery into streams.
- During opening or construction of any landings, material will not be sidecast into intermittent or perennial stream channels.
- At project conclusion, landings will be configured for long-term drainage and stability by reestablishing natural runoff patterns. All landings will be covered with at least 50 percent effective soil cover. Use of certified weed free materials including straw, wood chips, or mulch may be used where on-site material is insufficient.

BMP 1.13 – Erosion Prevention and Control Measures During Timber Sale Operations:

Ensures that Purchasers operations shall be conducted reasonably to minimize soil erosion. This is accomplished during the pre-operations meeting with the purchaser, and throughout the operations phase of the timber sale.

- Erosion control measures are discussed during the pre-operations meeting with the purchaser and the Forest Service. They are updated throughout the operations phase of the timber sale.
- The Klamath Wet Weather Operation Standards (USDA Forest Service 2002) will be used for all project activities (harvest, hauling, planting).

BMP 1.16 – Log Landing Erosion Prevention and Control:

Works to reduce erosion and subsequent impacts sedimentation from log landings. Timber Sale Contract provide for erosion prevention and control measures on all landings. This is best done by design of landing drainage measures during the planning phase of the project, and implemented during the operations phase.

- See BMP 1.12.

BMP 1.17 – Erosion Control on Skid Trails:

Employs preventive measures such as drainage structures to reduce water concentration and erosion. This is accomplished during the operations phase of the project. Because of the timing of this project, pre-staging of straw bales for timely construction of water bars will be called for.

- Where skidding occurs through units with less than 50 percent soil cover, mulch skid trails of greater than 15 percent slope, to achieve at least 50 percent effective soil cover on skid trails (approximately 40 acres across the project area may require this). Effective soil cover could include plant litter, woody material in contact with the soil, living vegetation, and rock fragments with a diameter of ½ to 3 inches. Use of certified weed free materials including straw, wood chips, or mulch may be used where on-site material is insufficient.

BMP 1.18- Meadow Protection during Timber Harvest:

The objective is to avoid damage to ground cover, soil and hydrologic function of meadows.

- Equipment will be excluded from wetlands or wet meadows (excluding small springs and seeps).

BMP 1.19 – Streamcourse Protection:

Protects the natural flow of streams and reduces the entry of sediment and any other pollutants into streams. The location of stream crossings must be agreed to by the Sale Administrator and the Hydrologist. The accomplishment of the objective of this measure is during the operations phase of the project.

- Tractors and mechanical harvesters will be excluded from all Riparian Reserves associated with stream channels, active landslides, inner gorges, and toe zones of dormant landslide deposits. In roadside hazard tree removal units, ground based equipment will be restricted to the road surface.
- To limit slope disturbance, inner gorge terrain (greater than 65 percent slope) that extends beyond Riparian Reserves will be buffered by 20-foot slope distance and excluded from mechanical equipment activities. In areas where treatments may conflict, a hydrologist will be consulted.
- All hazard trees cut within 25 feet of a stream channel or spring will be left on site unless it continues to pose a threat to safety or accessibility (see watershed-4 for equipment exclusion restrictions). Along all stream channels (perennial and intermittent), all hazard trees 26 inches in diameter at breast height and greater within the first site tree (150-170 feet) will be left on site unless after felling, it continues to pose a threat to safety, infrastructure, forest road drainage system integrity or accessibility.
- Any hazard tree (equal or greater than 26 inches) below a road that would contact a fish bearing stream channel if felled that direction will be retained on site.
- Live trees directly rooted into the banks or otherwise integral to the stability of the channel bank will not be felled unless they pose an overhead hazard and, if felled, will be left on site unless this poses a hazard on the ground per Forest Service safety requirements.
- Directional felling will be used to protect streambanks where hazard trees need to be mitigated for public or employee safety.

BMP 1.20 – Erosion Control Structure Maintenance:

Requires periodic inspection of erosion control structures to assess maintenance needs and effectiveness. This is accomplished during the operations and post-operations phase of the project; this ensures the adequacy of erosion control measures.

- Skid trail erosion control work will be kept current during implementation. Erosion control and drainage of skid trails will be complete prior to shutting down operations due to wet weather or at project completion.

BMP 1.21 – Acceptance of Erosion Control Measures Before Timber Sale Closure:

Erosion control measures are inspected for adequacy to ensure erosion control as planned. This is accomplished during the post-operations phase of the project during the contract final inspection.

- At project completion, permanent operating water bars will be installed and/or repaired as necessary on all skid trails, and slash scattered on all skid trails if necessary.
- The Timber Sale Administrator will inspect the Erosion Control Measures for compliance with contract.

BMP 2.4 – Road Maintenance and Operations (Temporary Roads):

The objective is to improve road slope stabilization by applying mechanical and vegetative measures. This is accomplished during the operations phase of the project.

- New temporary roads or landings will not be constructed in any Riparian Reserve associated with stream channels, on toe zones of landslides, active landslides or inner gorges. Exceptions for this project design feature for Alternative 2: Landings # DZ03, DZ10, DZ23, L043, L044, and L090. For the six new landings in Riparian Reserve approved for use in this project, Forest Service watershed specialists will be involved in site specific decisions related to vegetation removal, drainage and erosion control, and hydrologic stabilization.
- Following harvest activities achieve at least 50 percent effective soil cover on new temporary roads (if it's available on site) and block them after the harvest season (prior to the first winter after use). Depending on soil texture and slope, new temporary roads will also be sub-soiled, tilled (or tilled, or roughed up) after use.
- All temporary roads (new, existing or re-opened decommissioned roads) will have the takeoffs from system road obliterated or blocked to avoid unauthorized use. All temporary roads will be hydrologically stabilized including removal of culverts and fills at stream crossings, out-sloping of road surfaces, and proper construction of water bars. Erosion and sedimentation control structures (water bars) will be maintained and repaired per the guidance in the Forest Service Handbook 2409.15 R5 Supplement.

BMP 2.4 – Road Maintenance and Operations (System Roads)

- Improvements to existing system roads in the project area will avoid over-steepened road cuts where possible, minimize sidecasting, and maintain ditches, cross drains, and any outsloped road segments.
- Roads will be watered as appropriate to maintain road fines on site. Other materials may be used for dust abatement as approved by the Forest Service.
- Upgrades or improvements to stream crossings will be built to Forest Plan standards.
- Activities which require culvert replacement or removal will occur during the least critical periods for water and aquatic resources: when streams are dry or during

low-water conditions; and in compliance with spawning and breeding season restrictions.

- Legacy sediment site treatments within or adjacent to streams will have erosion-prevention techniques applied such as silt fences, straw wattles, or mulch to minimize the risk of discharge. All project-related temporary structures, materials and project-related debris will be removed from riparian areas and stream channels prior to wet weather and winter shutdown.
- For legacy sediment site repairs, fill materials generated will be reincorporated back into subgrade to the extent possible; all excess fill materials will be spoiled at a site reviewed and approved by Forest Service botanist, watershed, and heritage specialists.

BMP 2.5 - Water Source Development Consistent with Water Quality Protection:

The objective is to limit and mitigate the effects of water source development through the planning of impoundments and withdrawals.

- Draft water only at sites designated by the Forest Service. Decisions related to where water drafting occurs will be coordinated with a Forest Service fisheries biologist so that potential impacts to anadromous fish, and the thermal refugia they rely upon, are sufficiently minimized.
- Sites that are not likely to have rearing Coho salmon present will be prioritized for use, such as mainstem sites on the Klamath, Scott, and Salmon rivers. Priority will also be given to sites that involve drafting relatively warmer waters in mainstem rivers; drafting from tributaries and colder water sources, especially in their lower reaches, will be avoided particularly during late summer and early fall (when fish survival is dependent upon thermal refugia). Water storage facilities such as foldable tanks are encouraged and will be assessed for sites with moderate flows that simultaneously support rearing SONCC coho salmon, and may be subject to high drafting use (e. g., Walker Creek). Project-related water drafting will be monitored, and shifted away from streams if their baseflows will no longer sustain drafting-related water withdrawal consistent with PDFs. The following creeks will be avoided, due to their small size, small summer base flows, and consistent presence of rearing SONCC Coho salmon - Tom Martin Cr, O'Neil Cr, Little Horse Cr, and China Cr.
- When drafting from waters designated as coho salmon Critical Habitat: NOAA Fisheries Water Drafting Specifications (2001) apply:
- Intakes will be screened with 3/32" mesh for rounded or square openings, or 1/16" mesh for slotted openings. When in habitat potentially occupied by steelhead trout, intakes will be screened with 1/8" mesh size. Wetted surface area of the screen or fish-exclusion device shall be proportional to the pump rate to ensure that water velocity at the screen surface does not exceed 0.33 feet/second.
 1. Use of a NOAA approved fish screen will ensure the above specifications are met.
 2. Fish screen will be placed parallel to flow.
 3. Pumping rate will not exceed 350 gallons-per-minute or 10 percent of the flow of the anadromous stream drafted from.
 4. Pumping will be terminated when tank is full.

5. Additional applicable specifications:
 6. There will be no modification/improvement of drafting sites in Coho Critical Habitat.
- Water drafting by more than one truck shall not occur simultaneously.
 - When drafting from waters that are not coho salmon Critical Habitat, Forest Service BMP 2.5 direction applies:
 1. For fish-bearing streams, the water drafting rate should not exceed 350 gallons per minute for streamflow greater than or equal to 4.0 cubic feet per second (cfs).
 2. Below 4.0 cfs, drafting rates should not exceed 20 percent of surface flows.
 3. Water drafting should cease when bypass surface flows drop below 1.5 cfs.
 4. Intakes, for trucks and tanks, shall be placed parallel to the flow of water and screened, with opening size consistent with the protection of aquatic species of interest.
 5. Fish-bearing streams that are temporarily dammed to create a drafting pool shall provide fish passage for all life stages of fish.
 6. For non-fish-bearing waters, drafting rate should not exceed 350 gallons per minute for stream flow greater than or equal to 2.0 cubic feet/second.
 7. Drafting rate should not exceed 50 percent of surface flow.
 8. Drafting should cease when bypass surface flow drops below ten gallons per minute.
 9. Drafting by more than one truck shall not occur simultaneously.
 - Rock and gravel will be applied to drafting sites if it is needed to prevent stream sedimentation.
 - Water drafting sites located outside of Coho salmon Critical Habitat only may include minor instream modification, such as fine sediment removal and building of temporary dams with board/plastic. All board and plastic materials will be removed after use and prior to winter shutdown.

BMP 2.11 - Servicing and Refueling of Equipment:

Prevent fuels, lubricants, cleaners, and other harmful materials from discharging into nearby surface waters or infiltrating through soils to contaminate groundwater resources.

- Refueling will not take place within Riparian Reserves except at designated landings in locations where most disconnected from water resources. A spill containment kit will be in place where refueling and servicing take place.

BMP 2.13 – Erosion Control Plan:

Effectively limit and mitigate erosion and sedimentation from any ground-disturbing activities, through planning prior to commencement of project activity, and through project management and administration during project implementation.

- An Erosion Control Plan will be completed prior to project implementation.
- The Forest's Wet Weather Operations Standards are included in the Erosion Control Plan.

BMP 5.2 – Slope Limitations for Mechanized Equipment Operations:

The objective is to reduce gully and sheet erosion and associated sediment production by limiting tractor use.

- See BMP 1.9 and 1.10.

BMP 5.5 – Disposal of Organic Debris:

The objective is to prevent gully and surface erosion with associated reduction if sediment production and turbidity during and after treatment.

- During site preparation, material greater than 8” inches in diameter would not be removed unless needed to reduce 1,000 hour fuel loading to seven tons per acre, retain as close to seven tons per acre as possible.

BMP 5.6 – Soil Moisture Limitations for Mechanical Equipment Operations:

The objective is to prevent soil compaction, rutting, and gulling that may result in increased sedimentation and turbidity.

- All ground based equipment will follow the Wet Weather Operation Standards.

BMP 6.3 Protection of Water Quality from Prescribed Burning Effects:

The objective is to maintain soil productivity; minimize erosion; minimize ash, sediment, nutrients, and debris from entering water bodies.

- Prescribed fire effects in Riparian Reserves will mimic a low intensity backing fire, except for handpiles where higher intensity may occur to consume pile material. Ignition of underburns will generally not occur in Riparian Reserves. Approval by the District Fish Biologist is needed for underburn Riparian Reserve ignitions.
- Handpiles and windrows in Riparian Reserves will be placed in a checkerboard pattern whenever possible (not piled directly above another). Handpiles will be less than 6 feet in diameter and will be more than 15 feet away from intermittent streams and 30 feet away from perennial streams.
- For underburning, hand-line construction in riparian vegetation shall be avoided and in general should be farther than 25 feet from stream channels. Handlines will be mitigated (waterbarred and covered with organic material) immediately following prescribed burning, when safe to do so.

References for Best Management Practices _____

USDA Forest Service. 2013c. Klamath National Forest Best Management Practices Evaluation Program: Water Quality Monitoring Report 2013. Klamath National Forest, Yreka, CA. Retrieved from <http://www.fs.usda.gov/detail/klamath/landmanagement/resourcemanagement/?cid=stelprdb5312713> on June 6, 2014.

USDA Forest Service. 2011. Soil and Water Conservation Handbook. Chapter 10 – Water Quality Management Handbook.

USFS. 2002. Wet Weather Operating Standards. Klamath National Forest, Region 5. US Forest Service.