

APPENDIX C

BEST MANAGEMENT PRACTICES (BMPs)

INTRODUCTION:

Best Management Practices (BMPs) are the primary mechanism to enable the achievement of water quality standards (Environmental Protection Agency 1987). This Appendix describes the Forest Service's BMP process. It lists the key Soil and Water Conservation Practices (SWCP) as outlined in Forest Service Handbook 2509.22 that are to be used during the planning and/or implementation of the proposed actions described for Alternative 2 thru 5 of the Moose Post-Fire Project. Also described are each SWCP that would be refined for site-specific conditions to protect beneficial uses and meet water quality objectives.

BMPs include, but are not limited to, structural and nonstructural controls, operations, and maintenance procedures. BMPs can be applied before, during, and after pollution producing activities to reduce or eliminate the introduction of pollutants into receiving waters. Usually BMPs are applied as a system rather than a single practice. BMPs are selected based on site-specific conditions that reflect natural background conditions and political, social, economic, and technical feasibility.

STATE REQUIREMENTS FOR PROTECTION OF WATER QUALITY:

Compliance with State requirements for protection of waters of the State of Montana (Administrative Rules of Montana, 16.20.603) means that "land management activities must not generate pollutants in excess of those that are naturally occurring regardless of the stream's classification. 'Naturally occurring' is defined in the Administrative Rules as that water quality condition resulting from runoff or percolation over which man has no control or from developed land where all 'reasonable' land, soil, and water conservation practices' have been applied." The Administrative Rules also state "Best Management Practices are 'reasonable' only if beneficial uses are protected" (i.e. fisheries). Land management activities that comply with Montana water quality law and regulations have three elements in common:

1. BMPs are applied;
2. Beneficial uses are not impaired; and
3. Monitoring is in place to test whether BMPs are adequate to protect beneficial uses.

Montana State Water Quality Standards require the use of Reasonable Land, Soil, and Water Conservation Practices (analogous to BMPs) as the controlling mechanism for non-point pollution. Use of BMPs is also required in the April, 1987 Memorandum of Understanding (MOU) between the Forest Service and the State of Montana as part of our responsibility as the Designated Water Quality Management Agency on National Forest System lands.

BMP IMPLEMENTATION PROCESS:

In cooperation with the State, the Forest's primary strategy for the control of non-point sources is based on the implementation of preventive practices (BMPs) determined necessary for the protection of the identified beneficial uses.

The Forest's Non-point Source Management System consists of:

1. BMP selection and design based on site-specific conditions; technical, economic and institutional feasibility; and the designated beneficial uses of the streams.
2. BMP application.
3. BMP monitoring to ensure that they are being implemented and are effective in protecting designated beneficial uses.
4. Evaluation of BMP monitoring results from 'step' 3.

5. Feeding back the results into current/future activities and BMP design. The District Ranger is responsible for ensuring that this BMP feedback loop is implemented on all projects.

FORMAT OF THE BMPS:

The Practices (BMPs) described herein are tiered to the practices in Forest Service Handbook 2509.22 (Soil and Water Conservation Practices Handbook.) They were developed as part of the NEPA process, with interdisciplinary involvement and meet Forest and State water quality objectives.

Each Soil and Water Conservation Practice (SWCP) listed below is described as follows:

- **TITLE:** Includes the sequential number of the Practice and a brief title.
- **MONTANA BMPS:** Includes references for compliance to the State BMPs.
- **MOOSE POST-FIRE PROJECT SPECIFIC BMPS:** A listing of any project specific BMP to be used during the implementation of the Moose Post-Fire Project.
- **OBJECTIVE:** Describes the SWCP objective(s) and the desired results for protecting water quality.
- **EFFECTIVENESS:** Provides a qualitative assessment of expected effectiveness that the applied measure would have on preventing or reducing impacts on water quality. The SWCP effectiveness rating is based on literature and research, administrative studies, and professional experience. The SWCP is rated High, Moderate, or Low based on the following criteria:
 - a. Literature/Research (must be applicable to area)
 - b. Administrative studies (local or within similar ecosystem)
 - c. Experience (judgment of an expert by education and/or experience)
 - d. Fact (obvious by reasoned, logical response or observation)
- **IMPLEMENTATION:** This section identifies how the BMP practices are expected to be applied during project implementation.

Following the section on SWCPs, all the appropriate BMPs for the Moose Post-Fire Project are listed as extracts from the Best Management Practices for Forestry in Montana (Dec. 1997).

ITEMS COMMON TO ALL SOIL AND WATER CONSERVATION PRACTICES:

Responsibility for Implementation: The Hungry Horse/Glacier View District Ranger is responsible for ensuring that all applicable SWCPs are applied and implemented. The Operation Team Leader is responsible for ensuring that the objectives of the SWCPs identified in this appendix are incorporated into the Timber Sale Contract by use of the appropriate Timber Sale Contract CT provisions. The Timber Sale Administrator is responsible for ensuring that contract provisions are properly administered on the ground.

Monitoring: The Timber Sale Administrator, Forest Soil Scientist, and Forest Hydrologist as needed, would monitor the effectiveness of the applied SWCPs. Should the practice not be effective in meeting State or Forest Plan standards, the practice or project activity would be redesigned, rescheduled, or dropped.

SWCPs FOR THE MOOSE POST-FIRE PROJECT:

The applicable SWCPs are listed by practice number along with the objective of the practice described. The related Montana State BMPs are listed and any Moose Post-Fire Project specific BMPs are also listed. The references for the Montana State BMPs are not listed in this document.

PRACTICE 11.07 - Oil and Hazardous Substance Spill Contingency **PRACTICE 15.11 - Servicing and Refueling of Equipment**

MONTANA BMPs: VII A 1-2.

OBJECTIVE: To minimize contamination of waters from accidental spills of fuels, lubricants, bitumen, raw sewage, wash water, and other harmful materials by prior planning and development of Spill Prevention Control and Countermeasure Plans.

EFFECTIVENESS: High [obvious by reasoned, logical response or observation]

b The Contracting Officer, Engineering Representative, or certified Sale Administrator would designate the location, size, and allowable uses of service and refueling areas. They would also be aware of actions to be taken in case of a hazardous spill, as outlined in the Forest Hazardous Substance Spill Contingency Plan (SWCP 11.07). Contract provisions CT6.34 Sanitation and Servicing and BT6.341 Prevention of Oil Spills are included in all timber sale contracts. BT6.341 requires the purchaser to prepare a spill prevention control and countermeasure plan, which shall meet applicable EPA requirements, including certification by a registered professional engineer. This requirement is enacted when the total oil or oil products storage exceeds 1,320 gallons, or if any single container exceeds a capacity of 660 gallons.

PRACTICE 14.02 – Timber Harvest Unit Design **PRACTICE 13.06 - Soil Moisture Limitations for Tractor Operation** **PRACTICE 13.02 - Slope Limitations for Tractor Operation**

MONTANA BMPs: IV A 1, 2, 4, 5, 6. IV B 1, 6; IV C 2, 5.

OBJECTIVE: To insure that timber harvest unit design would secure favorable conditions of water flow, maintain water quality and soil productivity, and reduce soil erosion and sedimentation, during and following salvage logging.

These recommendations are based on burn severity ratings, (the fire's effect on soil) and on slope, which relates to erosion hazard. In addition, special management practices are outlined for units where the fine branches and needles were completely burned.

Low/unburned or Low Burn Severity Rating:

In general, our standard contract provisions would adequately protect soils with low or unburned severity rating classes.

On slopes < 35 percent (units 12, 13, 19, 20, 27, 29, 43, 44, 62, 67):

- Winter log
- Summer log using dedicated skid trails spaced 75 feet apart when soils are moist as determined by the field method
- If equipment can not operate at 75 foot spacing then the trails can be closer if the equipment operates on a slash mat consisting of fine material less than 3 inches in diameter and needles.
- Summer log using dispersed skidding when soils are dry or moist as determined by the field method. Be aware that the soils are unlikely to dry if the vegetation is mostly dead.

On slopes > 35 percent (Units 15, 16, 17, 23, 24, 25, 37, 38, 40, 41, 49, 50, 53, 54, 55, 56, 58, 66, 70, 75):

- Cable log in summer or winter

- Helicopter log

Pre-bunching logs with a feller-buncher is acceptable if the soils are snow covered

Moderate Burn Severity Rating:

On slopes < 35 percent (units 1, 2, 3, 4, 8, 10, 21, 26, 28, 35, 68, 69):

- Winter log
- Summer log using dedicated skid trails with a slash mat consisting of fine material less than 3 inches in diameter and needles.
- Cable log
- Helicopter log

On slopes > 35 percent (Units 5, 6, 9, 11, 14, 18, 22, 30, 31, 33, 34, 52, 57, 59, 61, 63, 64, 65, 72, 73, 76, 77, 78) the following options are acceptable:

- Cable log in summer or winter
- Helicopter log
- Pre-bunch logs only if the soils are snow covered
- All cable corridors would have slash placed so it covers > 50 percent of the ground after yarding operations are completed
- All corridors would have hand constructed waterbars installed at least 50 feet apart
- Logs would be skidded with their leading edge suspended

High Burn Severity Rating:

On slopes <35 percent (no units are in this situation) the following options are acceptable:

- All ground based skidding would operate in winter on snow or frozen ground.
- Helicopter or cable systems are acceptable

On slopes > 35 percent (unit 48) the following options are acceptable:

- Helicopter log any season
- Cable log in winter on snow or frozen ground
- Ground based equipment is not acceptable
- Mechanical pre-bunching is not allowed

Other management practices to protect soil from erosion and maintain soil productivity include the following:

a) Winter logging would be done when the ground has enough snow or is frozen enough so operations do not cause wet muddy soil to bleed into the snow or appear in the tracks.

b) Fine branches and foliage would be left in the units. This practice has two purposes; 1) to provide ground cover that reduces soil erosion rates and, 2) to provide nutrients. Whole tree yarding is not acceptable.

c) Ideally, a slash mat would be six inches thick and constructed of the fine branches and twigs and needles removed during processing. Small tops less than 3 inches in diameter are also suitable. Log sized material is less well suited to protecting the soil from detrimental impacts.

d) Both large woody debris (stems greater than 3 inches in diameter) and fine organic matter would be left on the harvest sites. Snags, live trees, larch greater than 18 inches in diameter, and non-merchantable trees would be left in the units.

e) If mechanical fuel treatments are deemed necessary they would be accomplished with excavators to reduce soil disturbance.

f) Units 17, 18, 21, 22, 64, and 65 would be examined following salvage harvest for the need to implement contour felling on the downhill border of the harvest units, in order to increase the amount of down woody

material on the ground to reduce the potential for overland flow to occur (to be accomplished by Forest Service).

g) Specific actions related to noxious weed concerns include the following:

- Minimize ground disturbance by using helicopters, skyline cable systems, and other mechanized equipment that has proven capability to be "light on the land" (such as rubber tired skidders or feller/bunchers).
- Use mechanized equipment only on areas where terrain and soil conditions would cause minimal impact to soils (slopes generally less than 35%).
- Operate equipment only when soils are at an acceptable level of dryness.
- Designate main skid trails and temporary access roads and/or lay down treetops and limbs on these trails to protect the soil during skidding operations.
- Wash all off-road equipment before entering the area and upon moving between sites on the Flathead National Forest.
- Re-establish vegetation on bare ground created by road decommissioning or timber harvest activity, using native material where appropriate and available.

EFFECTIVENESS: High - Experience of local expert, [obvious by reasoned, logical response or observation]

IMPLEMENTATION: The following features would be designated on the Timber Sale Area Map:

- 1) Moose Post-Fire Project Specific BMPs would be implemented primarily with the use of timber sale contract clause CT6.4, or other appropriate contract provisions.

PRACTICE 14.03 - Use of Sale Area Maps for Designating Soil and Water Protection Needs

MONTANA BMPs: IV A 1.

OBJECTIVE: To delineate the location of protection areas and special treatment areas, to ensure their recognition, proper consideration, and protection on the ground.

EFFECTIVENESS: High [obvious by reasoned, logical response or observation]

IMPLEMENTATION: The following features would be designated on the Timber Sale Area Map:

- 2) Stream courses (perennial and intermittent) to be protected under contract clause BT6.5
- 3) Special treatment zones (STZS) as needed as per contract clause CT6.62 (site specific wetland protection measures).

PRACTICE 14.10 - Log Landing Location and Design

PRACTICE 14.11 - Log Landing Erosion Prevention and Control

PRACTICE 14.12 - Erosion Prevention and Control Measures During Timber Sale Operations

PRACTICE 14.13 - Special Erosion Prevention Measures on Areas Disturbed by Harvest Activities

PRACTICE 14.14 - Revegetation of Areas Disturbed by Harvest Activities

PRACTICE 14.15 - Erosion Control on Skid Trails

MONTANA BMPs: III A 1,3, 6; III B 1, 6; IV A 5, 6; IV B 4, 5, 6.

Landings:

- a) During periods of use, landings would be maintained in such a manner that debris and sediment are not delivered to any streams.

- b) Landings would drain in a direction and manner that would minimize erosion and would preclude sediment delivery to any stream.
- c) Standard Timber Sale Contract provision B6.64 Landings requires that after landings have served the Purchaser's purpose, the Purchaser shall ditch or slope them to permit water to drain or spread. Landings would be seeded as needed with a mix approved by the Forest Soil Scientist.

Skid Trails:

- a) Skid trails would be water-barred, the location and spacing would be designated by the Sale Administrator (SWCP 15.25).
- b) Skid trails likely to produce sediment would be covered with slash and/or seeded with a mix of seed and fertilizer specified in CT6.601.

MOOSE POST FIRE PROJECT SPECIFIC BMPs for all applicable landings and units:

- 1) Helicopter landings would be located on flat areas away from streams and outside the cutting units. The Helicopter landings would be ripped and seeded following use. In some cases roads may be used as helicopter landings.
- 2) Install waterbars or place slash or do both as needed to control overland flow and erosion on all skid trails at the completion of the project.
- 3) All skyline corridors would have waterbars installed. On cable yarding corridors lay treetops and limbs/slash on the ground in those areas where logs make contact with the ground, leaving areas of bare soil.

OBJECTIVE: To protect water quality by minimizing erosion and subsequent sedimentation derived from log landings and skid trails.

EFFECTIVENESS: High (experience of the soil scientist, sale administrator, and ID Team members are that these requirements and criteria are highly effective in minimizing soil erosion)

IMPLEMENTATION: Standard Timber Sale provision BT6.6 requires the purchaser to conduct operations in a reasonable fashion to minimize erosion. Additionally, specific erosion requirements would be spelled out in provisions such as CT6.4, CT6.6, CT6.601, CT6.62, and CT6.623. The following criteria would be used in controlling/minimizing erosion, restoring landings and skid trails. Moose Post Fire Project Specific BMPs would be implemented primarily with the use of timber sale contract clause CT6.4, or other appropriate contract provisions.

PRACTICE 14.18 - Erosion Control Structure Maintenance

MONTANA BMPs: III E 2,8; IV B 4, 6.

OBJECTIVE: To ensure that constructed erosion control structures are stabilized and working effectively.

EFFECTIVENESS: High (experience of the soil scientist, sale administrator, and ID Team members are that the following requirement is highly effective in minimizing soil erosion)

IMPLEMENTATION: Timber Sale Contract provision, BT6.66, requires that during the period of the contract, the Purchaser shall provide maintenance of soil erosion control structures constructed by the Purchaser until they become stabilized. The Forest Service may agree to perform such structure maintenance under BT4.228 Cooperative Deposits, if requested by the Purchaser, subject to agreement on rates. Should the Purchaser fail to do seasonal maintenance work, the Forest Service may assume the responsibility and charge the Purchaser accordingly. The Timber Sale Administrator would ensure that erosion control structures are working effectively.

PRACTICE 14.19 - Acceptance of Timber Sale Erosion Control Measures Before Sale Closure

MONTANA BMPs: III C 8; VI B 6;

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

IMPLEMENTATION: Timber Sale Contract provision, BT6.36, requires that upon the Purchaser's written request and assurance that contract work has been completed; the Forest Service shall perform an acceptance inspection. For erosion control work, "acceptable" means only minor deviation from established standards, provided no major or lasting impact is caused to soil and water resources. The Timber Sale Administrator would not accept as complete, any erosion control work that does not meet this criteria.

EFFECTIVENESS: High [obvious by reasoned, logical response or observation]

PRACTICE 15.06 - Mitigation of Surface Erosion and Stabilization of Slopes

MONTANA BMPs: III E 8.

BEST MANAGEMENT PRACTICES FOR FORESTRY IN MONTANA December 1997 (Revision of 1988 BMPs to include SMZ law requirements)

I. DEFINITIONS

1. "Hazardous or toxic material" means substances which by their nature are dangerous to handle or dispose of, or a potential environmental contaminant, and includes petroleum products, pesticides, herbicides, chemicals, and biological wastes.
2. "Stream," as defined in 77-5-302(7), MCA, means a natural water course of perceptible extent that has a generally sandy or rocky bottom or definite banks and that confines and conducts continuously or intermittently flowing water.
3. "Streamside Management Zone (SMZ)" or "zone" as defined at 77-5-302(8), MCA means "the stream, lake, or other body of water and an adjacent area of varying width where management practices that might affect wildlife habitat or water quality, fish, or other aquatic resources need to be modified." The streamside management zone encompasses a strip at least 50 feet wide on each side of a stream, lake, or other body of water, measured from the ordinary high water mark, and extends beyond the high water mark to include wetlands and areas that provide additional protection in zones with steep slopes or erosive soils.
4. "Wetlands" mean those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands include marshes, swamps, bogs, and similar areas.
5. Adjacent wetlands are wetlands within or adjoining the SMZ boundary. They are regulated under the SMZ law.
6. Isolated wetlands lie within the area of operation, outside of the SMZ boundary, and are not regulated under the SMZ law.

II. STREAMSIDE MANAGEMENT

The Streamside Management Law (77-5-301 through 307 MCA) provides minimum regulatory standards for forest practices in streamside zones (SMZ). The “Montana Guide to Streamside Management Zone & Rules” is an reference to describe management opportunities and limitations within SMZ’s.

III. ROADS

A. Planning and Location

1. Minimize the number of roads constructed in a watershed through comprehensive road planning, recognizing intermingled ownership and foreseeable future uses. Use existing roads, unless use of such roads would cause or aggravate an erosion problem.
3. Fit the road to the topography by locating roads on natural benches and following natural contours. Avoid long, steep road grades and narrow canyons.
6. Locate roads to provide access to suitable (relatively flat and well-drained) log landing areas to reduce soil disturbance.

B. Drainage from Road Surface

1. Provide adequate drainage from the surface of permanent roads. (a) Outsloped roads provide a means of dispersing water in a low energy flow from the road surface. Outsloped roads are appropriate when the fill slopes are stable, drainage would not flow directly into a stream channel, and transportation safety can be met.
4. Provide energy dissipaters (rock piles, slash, log chucks etc.) where necessary to reduce erosion at outlets of drainage features.
6. Route road drainage through adequate filtration zones or other sediment structures to ensure sediment doesn’t reach surface water. Install road drainage features above stream crossings to route discharge into filtration zones before entering a stream. Route road drainage through adequate filtration zones or other sediment-settling structures to ensure sediment doesn’t reach surface water. Install road drainage features above stream crossings to route discharge into filtration zones before entering stream (*applies to the access road on the private land*).

C. Construction

1. Keep slope stabilization, erosion and sediment control work current with road construction. Install drainage features as part of the construction process, ensuring that drainage structures are fully functional. Complete or stabilize road sections within same operating season.
2. Stabilize erodible, exposed soils, by seeding, compacting, riprapping, benching, mulching, or suitable means.
8. Place debris, overburden, and other waste materials associated with construction and maintenance activities in a location to avoid entry into streams. Include these waste areas in soil stabilization planning for the road.

E. Maintenance

2. Maintain erosion control features through periodic inspection and maintenance, including cleaning dips, and crossdrains, repairing ditches, marking culvert inlets to aid in location, and clearing debris from culverts.
8. Upon completion of seasonal operations, ensure that drainage features are fully functional. The road surface should be crowned, outsloped, insloped, or water-barred. Remove berms from the outside edge where runoff is channeled.

IV. TIMBER HARVESTING AND SITE PREPARATION

A. Harvest Design

1. Plan timber harvest in consideration of your management objectives and the following:

- a) Soils and erosion hazard identification.
- b) Rainfall.
- c) Topography.
- d) Silvicultural objectives.
- e) Critical components (aspect, water courses, landform, etc.).
- f) Habitat types.
- g) Potential effects on water quality and beneficial water uses.
- h) Watershed condition and cumulative effects of multiple timber management activities on water yield and sediment production.
- i) Wildlife habitat.

- 1) Use the logging system that best fits the topography, soil type, and season, while minimizing soil disturbance and economically accomplishing silvicultural objectives.
3. Use the economically feasible yarding system that would minimize road densities.
4. Design and locate skid trails and skidding operations to minimize soil disturbance. Using designated skid trails is one means of limiting site disturbance and soil compaction. Consider the potential for erosion and possible alternative yarding systems prior to planning tractor skidding on steep or unstable slopes.
5. Locate skid trails to avoid concentrating runoff and provide breaks in grade. Locate skid trails and landings away from natural drainage systems and divert runoff to stable areas. Limit the grade of constructed skid trails on geologically unstable, saturated, highly erosive, or easily compacted soils to a maximum of 30%. Use mitigating measures, such as water bars and grass seeding, to reduce erosion on skid trails.
6. Minimize the size and number of landings to accommodate safe, economical operation. Avoid locating landings that require skidding across drainage bottoms.

B. Other Harvesting Activities

1. Tractor skid where compaction, displacement, and erosion would be minimized. Avoid tractor or wheeled skidding on unstable, wet, or easily compacted soils and on slopes that exceed 40% unless operation can be conducted without causing excessive erosion. Avoid skidding with the blade lowered. Suspend leading ends of logs during skidding whenever possible.
4. For each landing, provide and maintain a drainage system to control the dispersal of water and to prevent sediment from entering streams.
5. Ensure adequate drainage on skid trails to prevent erosion. On gentle slopes with slight disturbance, a light ground cover of slash, mulch or seed may be sufficient. Appropriate spacing between water bars is dependent on the soil type and slope of the skid trails. Timely implementation is important.
6. When existing vegetation is inadequate to prevent accelerated erosion, apply seed or construct water bars before the next growing season on skid trails, landings and fire trails. A light ground cover of slash or mulch would retard erosion.

C. Slash Treatment and Site Preparation

1. Rapid reforestation of harvested areas is encouraged to reestablish protective vegetation.
2. When piling slash, care should be taken to preserve the surface soil horizon by using appropriate techniques and equipment. Avoid use of dozers with angle blades.
5. Carry out brush piling and scarification when soils are frozen or dry enough to minimize compaction and displacement.
7. Remove all logging machinery debris to proper disposal site.

8. Limit water quality impacts of prescribed fire by constructing water bars in firelines; not placing slash in drainage features and avoiding intense fires unless needed to meet silvicultural goals. Avoid slash piles in the SMZ when using existing roads for landings.

VI. WINTER LOGGING

A. General

2. Conduct winter logging operations when the ground is frozen or snow cover is adequate (generally more than one foot) to prevent rutting or displacement of soil. Be prepared to suspend operations if conditions change rapidly, and when erosion hazard becomes high.

VII. HAZARDOUS SUBSTANCES

A. General

1. Know and comply with regulations governing the storage, handling, application (including licensing of applicators), and disposal of hazardous substances. Follow all label instructions.
2. Develop a contingency plan for hazardous substance spills, including cleanup procedures and notification of the State Department of Environmental Quality.

B. Pesticides and Herbicides

1. Use an integrated approach to weed and pest control, including manual, biological, mechanical, preventive, and chemical means.

BMP EFFECTIVENESS

Best Management Effectiveness

BMP audits have occurred on the Flathead National Forest and Kootenai National Forests since 1988. Audits are a form of monitoring BMPs to determine if they were properly applied and if so were they effective at preventing soil or water impacts. Since 1988, individual BMPs have been audited or monitored 2232 times on the Flathead and Kootenai National Forests. They were effective 2211 times. The Kootenai and Flathead Forests were grouped together because they have similar climates and similar soils.

In order to analyze the results of the BMP audits they were grouped according to the soil type on which they occurred. The simplest way is to group them by either residual soils that formed from the underlying bedrock, or soils formed from glacial till. Looking at these soil criteria, BMPs were effective when properly applied on glacial soils 1585 times out of 1596 applications. BMPs were effective when properly applied on residual soils 154 out of 156 applications. An additional 480 BMPs were monitored without reference to the soil types on which they were applied. Of these, 472 were effective at protecting soil and water quality.

In summary, BMPs were effective 99.3 percent of the time they were properly applied on glacial till soils. They were effective 98.7 percent of the times they were properly applied on residual soils. Lumping all the audit results together regardless of their soil types and including the earliest audits that were not specific to soil type, BMPs were effective 99 percent of the time they were properly applied on the Flathead and Kootenai National Forests.

On an individual BMP basis, no particular BMP stood out as an ineffective practice to maintain soil and water quality. However, there are a few that were less than 100 percent effective when properly applied on soils formed in glacial till, the major soil type in the Moose project area. These include the following:

- Roads planning and location, BMP IIIA3, Fit road to the topography. This BMP was effective 95 percent of the time it was properly applied (21 out of 22 times). No new roads are planned for the Moose project.

- Road construction, BMP IIC1, keep slope stabilization, erosion and sediment control work current with road construction. This BMP was effective 93 percent of the time it was properly applied (25 out of 27 times). No new roads are planned for the Moose project.
- Road construction, BMP IIC2, Stabilize erodable exposed soils by seeding etc. This BMP was effective 87 percent of the time it was properly applied (39 out of 45 times). No new roads are planned for the Moose project.
- Site Preparation, BMP IVC5, carry out brush piling and scarification when soils are frozen or dry enough to minimize compaction and displacement. This BMP was effective 89 percent of the time it was properly applied (8 out of 9 times).
- Hazardous Substances, BMP VIIA1, know and comply with regulations governing storage, handling, application and disposal of hazardous substances. This BMP was effective 92 percent of the time it was properly applied (11 out of 12 times). It is most commonly applied to the handling of fuel and oil.

A copy of the summaries this is based on and which specific BMPs they refer to is available in the project record exhibit N-25

LITERATURE CITED

U.S. Environmental Protection Agency. 1987. Nonpoint Source Controls and Water Quality Standards. Washington, D.C.

