House Joint Resolution 49
Forest Practices and Watershed Effects

Final Report
Environmental Quality Council
December 1988

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ACKNOWLEDGEMENTS

The members and staff of the Environmental Quality Council wish to thank the many Montanans who generously contributed their time and expertise to our study of forest practices and watershed effects under House Joint Resolution 49. We express particular appreciation to the members of the Watershed Effects Working Group, the Best Management Practices Technical Committee, and the regional audit teams, all of whom tirelessly traveled the state and worked diligently in the conference rooms and the woods to help EQC meet its obligations to the Legislature under HJR 49. Without this assistance, this report would not have been possible. We also wish to acknowledge Bill Ehinger for his excellent work as the coordinator of the timber sale audits during the summer of 1988.

EXECUTIVE SUMMARY

In April 1987, the 50th Montana Legislature passed House Joint Resolution 49, directing the Environmental Quality Council to study:

* how current forest management practices are affecting watersheds in Montana;

* the range of management practices that conserve watersheds and maintain economically viable timber harvest operations; and

* the administrative framework promoting the use of best management practices in Montana and other states.

EQC was also directed to study actions that might be necessary to improve state programs, in consideration of both watershed and timber management goals. Findings and recommendations were to be reported to the 51st Legislature.

House Joint Resolution 49 was preceded by a number of efforts to enact forest practice legislation in Montana. Bills proposed during the 1973-75 legislative sessions would have authorized minimum state standards for timber harvesting, associated road construction, reforestation, chemical use, and disposal of logging slash. Opposition from non-industrial forest landowners led to the defeat of these bills, despite support from state agencies, environmental interests, and major segments of the timber industry. No forest practice legislation was introduced again until 1987, when House Bill 781 proposed a system of cooperative watershed agreements between the state and private forest owners. This bill was tabled by the House Natural Resources Committee, but the committee drafted a resolution to study forest watershed relationships. This resolution ultimately passed the full Legislature as HJR 49.

The HJR 49 study was organized around two technical committees appointed by EQC and composed of persons with expertise in timber harvest techniques and effects. The primary objective of the Watershed Effects Working Group was to assemble and review information pertinent to an assessment of the effects of forest practices on Montana watersheds. The Best Management Practices Technical Committee was charged with developing a consensus set of best management practices (BMPs) for forestry in Montana. Periodic EQC meetings, including presentations, discussions and field tours, also provided a forum for generating information and ideas on forest watershed issues.

To determine the rate of application and the effectiveness of forestry best management practices in Montana, the Watershed Effects Working Group audited a stratified random sample of 38 recent timber sales. These timber sales (which were all

harvested in 1986 and located within 200 feet of a perennial or intermittent stream) were divided among the major forest landowner groups -- industrial private, non-industrial private, state, and federal. Up to thirty-six separate management practices were evaluated at each sale location. The audits were conducted by three regional teams, each composed of five members and each having a range of technical expertise in forestry and watershed management.

The timber sale audits indicated that operators properly applied 82 percent of all management practices; 14 percent of the practices represented minor departures from best management practices; and 5 percent were rated as major departures. Failure to properly apply BMPs generally resulted in a failure of the practice to prevent the movement of sediment into streams. Minor departures generally led to minor effects, while major departures generally caused major impacts.

In 16 of the 38 sales, audit teams characterized at least one practice as having major detrimental impacts on soil and water resources. Impacts were projected to be extensive and long-term in 5 of these sales, while in the other 11 sales the major impacts were considered to be primarily short-term. Management practices in the remaining 22 timber sales were rated as having only minor detrimental impacts.

Management of streamside zones received the lowest overall ratings for application and effectiveness of BMPs; practices for controlling erosion from roads also had a high frequency of misapplication. The degree to which BMPs were applied was similar among nonindustrial private, industrial private and federal lands. The limited sample of state-owned timber sales indicated a higher degree of compliance with BMPs.

The best management practices developed by the Best Management Practices Technical Committee generally represent a consensus approach among technical specialists representing various perspectives on forest watershed issues. However, debate remains over how much specificity is desirable in the language for some individual BMPs. This debate generally hinges on finding the appropriate balance between the need for flexibility for the operator conducting forest practices versus the need for "bottom-line" guidance to prevent watershed impacts. The BMPs developed for streamside management zones are considerably more general than requirements in neighboring states, and may not provide adequate protection for water quality or stream quality.

The HJR 49 study also researched the legal and administrative structures used to promote the use of BMPs and to address forest practices and watershed effects in Montana and other states. This research indicates that achieving proper application of management practices to conserve watershed values involves a number of links, including appropriately written BMPs; knowledge of the BMPs by landowners and operators; a commitment

to include BMPs in sale planning and layout; and proper application of BMPs on the ground. To address these links, an effective state program should combine agency responsibility for BMPs; information/education; pre-sale assistance; prioritization of efforts to protect sensitive areas; oversight of BMP application; and monitoring of BMP effectiveness.

Montana's program to address forest practices and watershed effects has major weaknesses, including the lack of formal oversight of private forestry operations; limited education and pre-sale assistance; no procedure to identify high-priority watersheds; and no monitoring to assess either BMP effectiveness or the impacts of forest practices on beneficial uses. These weaknesses, primarily based on shortages of staff and financial resources, preclude Montana from effectively implementing a preventative approach to minimize potential damage to forest watersheds.

The HJR 49 report presents a number of options for Montana to address the major study question: "What is the most appropriate means for Montana to promote the use of best management practices in forestry operations?" These options include continuing current programs; adopting a forest practices act; requiring pre-notification for forest practices, coupled with increased education and pre-sale assistance by the Department of State Lands; licensing timber operators; adopting BMPs by rule under the Water Quality Act; and establishing a state-level interdisciplinary team to assist with private timber sale planning. Additional options are presented to improve the conduct of forest practices in streamside zones and to address other technical issues related to forest watershed management.

Preliminary Recommendations

The Environmental Quality Council developed preliminary recommendations for House Joint Resolution 49 at a meeting on December 9, 1988. The recommendations, organized to correspond to six potential elements of a forest practices water quality program, are as follows:

* **Best Management Practices**
  EQC endorsed the BMPs developed by the technical committee as the foundation for a consistent statewide set of forestry BMPs.
  EQC recognized the Department of State Lands as the lead agency to achieve consensus on a final BMP package; to publish the BMPs; and to establish a procedure for changing specific BMPs.

* **Information and Education**
  EQC endorsed DSL as the lead agency to coordinate educational programs on BMPs for timber operators, landowners, conservation district personnel and others. These educational programs should involve a variety of

agencies and organizations to effectively reach target audiences.

* **Pre-sale Assistance**
  EQC endorsed a proposal to require landowners or operators to notify DSL prior to conducting forest practices so that DSL can provide information on best management practices before logging and road-building begin.

* **Oversight of BMP Application**
  EQC adopted a motion authorizing DSL (or an interagency group under DSL) to monitor private forestry operations and to work cooperatively with sale administrators to promote voluntary use of BMPs to conserve watershed values.

* **Technical Issues**
  EQC endorsed efforts to make progress on refining BMPs for streamside zones; defining measurable standards for impairment of beneficial uses; addressing cumulative watershed effects; and monitoring forest water quality.

* **Follow-up**
  EQC endorsed the formation of an interagency group to conduct a series of timber sale audits in 1990. EQC also directed participating agencies to report and make recommendations to EQC and to the 1991 Legislature on the various elements of Montana's forest watershed program.

The Environmental Quality Council will hold a final meeting during the initial weeks of the 1989 legislative session to complete work on the House Joint Resolution 49. The purpose of the meeting is to develop a final legislative package to implement the programmatic response to the HJR 49 study, as outlined above. Specific discussion topics will include the level of staff and financial resources to be allocated to state agencies, further direction on interagency coordination, and the development of any legislation necessary to achieve the recommended elements of a Montana forest practices/watershed program.

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I. INTRODUCTION

The dual roles of forest land as a producer of wood fiber and a source of clean water have long been recognized. Only in the past two decades, however, has the relationship between timber harvest and watershed values begun to be rigorously investigated. The impetus for these efforts has been increasing public interest in water quality and water-based recreation, along with a growing awareness by resource managers of the need for watershed conservation.

Legislative responses of the federal government and many western states to potential timber/watershed conflicts have included amendments to the federal Clean Water Act, revisions to public land management statutes, and the enactment of state forest practice laws. House Joint Resolution 49, enacted in 1987 by the 50th Montana Legislature, represents Montana's initiative to develop information upon which to base sound natural resource policy decisions on the relationship between forest management and watershed effects.

This report is the result of a year-long study conducted by the Environmental Quality Council of the Montana Legislature. Following sections of this report present:

* an overview of forest practices and watershed effects;
* the history of HJR 49 and forest practice legislation in Montana;
* the organization and conduct of the study by the Environmental Quality Council;
* study findings;
* discussion;
* conclusions;
* evaluation of policy options; and
* a summary of the recommendations developed by the Environmental Quality Council.

II. WATERSHED EFFECTS OF FOREST PRACTICES

According to its title, House Joint Resolution 49 requests the Environmental Quality Council to study "the relationship between forest management and watershed effects". The term "watershed" as applied by the Environmental Quality Council and participants in the technical committees encompasses the quality, quantity, and beneficial uses of surface water produced from forested lands. "Forest management" means the series of practices used to access, remove and regenerate timber, and includes timber harvesting, associated road construction, the disposal of logging slash, and the preparation of a site for reforestation.

The relationships between forest practices and watershed effects are complex and difficult to quantify, but researchers have drawn a number of general conclusions about the interactions of primary concern in the HJR 49 study. The following discussion draws heavily from the Forest Practices Water Quality Management Plan (Idaho 1988a), which should be consulted for additional information and original research citations.

A. SEDIMENT

1. Sources of Sediment From Forest Practices

The addition of sediment to surface waters is the most significant watershed problem resulting from forest management. Forest practices generate sediment by removing vegetation and disturbing the ground surface, thus exposing forest soils to the erosive effects of water. During rain storms or snowmelt, moving water transports sediment downslope. The sediment can then enter streams and subsequently be carried downstream to rivers and lakes.

Various studies indicate that roads contribute more than 90% of the sediments entering streams from forest management activities. This sediment can be generated by direct movement of soil during road construction and maintenance, surface erosion from the road bed or slopes, and landslides (or other mass erosion) most commonly triggered by roading on steep, unstable ground. Other significant sources of sediments from logging operations can include erosion from streambanks damaged by heavy equipment and runoff from skid trails, particularly those formed by tractors yarding timber on steep slopes.

The magnitude of sediment increases resulting from forest practices varies widely, depending largely on weather, soil conditions, and management practices. In the Northern Rocky Mountains, the great majority of sediment transport to streams occurs during spring runoff. Storms, particularly rain-on-snow events, can rapidly increase both stream flows and instream sediment concentrations. Soils characteristic of the granitic batholiths (central Idaho and parts of western Montana), ancient

lake beds, and certain glacial deposits are highly sensitive to erosion when exposed by forest management or other development.

A third key factor is the degree to which appropriate management practices are applied to control the off-site movement of sediments. Sediment contributions from forest roads can be minimized through proper planning, route selection, design specifications, construction practices, drainage features, and soil stabilization. Buffer strips along streams and wind-rowed piles of logging slash along road beds have also been demonstrated as effective means to reduce the movement of sediment into streams. Careful design of skid trails and avoidance of heavy equipment in wet areas will also reduce the likelihood of sediment entering surface waters. Timely implementation of these measures can be crucial because most erosion occurs in the first year after management activities.

Sediment contributions from logging and roading decrease over time as exposed soils revegetate and road surfaces become more resistant to erosion. In one study of logging and roading on highly erosive soils, first-year sediment contributions to streams were measured at more than 1,500-times the amount from unlogged drainages. By the third year, sediment increases dropped to 50 times normal levels. Researchers in a separate logging study found that 84% of sediment produced in a six-year period came during the first year.

Sedimentation may also be caused by increased water yield from timber harvest, resulting in the hydraulic overloading of stream channels and consequent streambank erosion (see discussion of cumulative effects in section D. below).

2. Effects of Sediment

A primary concern over sedimentation of forest streams is the impact on trout populations. Instream sediment deposited on the stream bottom can decrease the success rate of egg hatching and fry development by impeding water flow through the gravels in which the eggs undergo early development. The absence of adequate flow results in low concentrations of dissolved oxygen and a buildup of metabolic wastes. Trout in the fingerling stage utilize the spaces between cobbles and boulders on the stream bottom to overwinter. Deposited sediment can reduce or eliminate this key habitat and again reduce trout survival.

These qualitative relationships among sediment, trout habitat, and trout survival have been long recognized, but are not easily quantified. Current research is focusing on developing standard methods of measuring deposited sediment, attributing these measurements to effects on trout populations, and determining threshold sediment levels.

Sedimentation can also affect the quality and availability of domestic water supplies. Fine sediment suspended in the water

makes the water cloudy (measured as turbidity), increases the cost of filtration, and interferes with chemical disinfection. Deposited sediment may fill intake reservoirs or otherwise interfere with the uptake of water for public water systems. A large number of Montana communities depend on forested watersheds for drinking water; currently logging operations occur in 11 public supply watershed in western Montana.

B. HABITAT CONDITIONS

Stream crossings, equipment operation in stream channels, deposition of slash in streams, and roadbuilding along streambanks are some of the forest practices that can alter instream habitat and adversely affect populations of fish and aquatic insects.

Researchers are now recognizing the importance of the periodic entry of woody debris into the stream channel -- particularly large logs that form stable cross-stream structures. These logs serve to dissipate stream energy and form pools that store sediment and provide fish habitat. Recent research on several Idaho watersheds found that sediment stored in such pools averages about 15 times the sediment annually transported by the streams (Megahan 1982). The author concluded that timber harvest operations should be designed to minimize changes in channel-sediment storage by keeping logging debris out of streams and by retaining some streamside timber to provide a source of natural channel debris over time. Other recent studies have also emphasized the need to retain mixed-age timber stands along streams to provide for aquatic habitat and long-term channel integrity.

C. OTHER WATER QUALITY PARAMETERS

Forest practices have the potential to affect water quality parameters other than sediment. The temperature of forest streams is controlled by the influence of inflowing groundwater and exposure to solar radiation. Removal of shading streamside vegetation allows more direct sunlight to reach the stream surface and can thus increase water temperatures to levels undesirable for aquatic communities, including fish and aquatic invertebrates.

Dissolved oxygen is a crucial determinant of a stream's suitability for aquatic life. Dissolved oxygen concentrations are controlled by water temperature and by instream biological activity. Additions of logging slash, leaves, and branches to a stream promote the growth of microorganisms that use up oxygen in the process of decaying the organic material. However, because most forest streams are fast moving and constantly aerated, shortages of dissolved oxygen are not generally a significant water quality issue in relation to forest practices.

Phosphorus and nitrogen are natural, but generally minor, components of forest stream chemistry. Forest practices can increase the instream concentrations of these nutrients through the input of ash (from burning for slash disposal) or the erosion of sediment from certain nutrient-rich soils. Nutrient additions are of particular concern where forest watersheds drain into lakes. Lakes receiving excess phosphorus or nitrogen may undergo cultural eutrophication, a degradation of water quality from man-caused nutrient additions. These excess nutrients can stimulate the growth of toxic blue-green algae and other undesirable life forms.

Herbicides and fertilizers used to promote timber stand regeneration can cause water quality problems if not properly applied. Improper disposal of used petroleum products, particularly waste oil from logging equipment, represents another potential source of pollution.

D. CUMULATIVE WATERSHED EFFECTS

The term "cumulative watershed effects" relates to changes in water quality, streamflow (water yield), channel structure, or aquatic habitat caused by the interaction of natural ecosystem processes with multiple forest practice operations.

Cumulative effects of forest practices may be exhibited incrementally -- for example, a gradual increase in water yield with the harvesting of each additional unit in a drainage. Cumulative effects may also occur suddenly, as in the case of the South Fork of the Salmon River in Idaho. During 1964, a combination of severe storms and a network of forest roads on steep, erosive slopes led to massive landslides into streams and the virtual elimination of spawning habitat for a major population of salmon and steelhead (Wann 1988). More typically, however, cumulative sediment impacts on a stream are considered to occur gradually from additional soil exposure and consequent erosion as a drainage is developed by timber harvest operations.

The potential for increased water yield resulting from timber removal has also drawn considerable recent attention as more land managers begin to consider cumulative effects. When rain or snow falls on an undisturbed forest, a share of the moisture is intercepted by the forest canopy and evaporates. The remainder reaches the forest floor where a significant proportion is taken up by trees and returned to the atmosphere through evapo-transpiration. The remaining water infiltrates the forest litter and soil, enters the groundwater and surfaces in streams.

The removal of forest cover through clearcutting or other intensive harvest activities eliminates the trees that normally act as water "pumps." As a result, more rain or snowmelt enters the groundwater and reaches the streams. Clearcuts also increase the amount of moisture reaching the ground, because interception by the forest canopy is eliminated and because shifting wind

patterns can lead to the deposition of more snow in forest openings.

Major concerns with increased water yield in the Northern Rockies relate to peak streamflows and the timing of runoff. In general, increased water yields raise the possibility of increased peak flows and/or longer duration of peak flows. These conditions can exceed the capacity of streams to handle spring runoff, and lead to damage of streambeds, banks and associated aquatic habitat. Increased sedimentation can also result from these alterations of the stream channel. Headwater streams are more susceptible to degradation by hydraulic overloading than are larger streams.

Forest Service guidelines generally consider a predicted 8-10 percent increase in water yield as a trigger for more intensive evaluation of proposed forest management activities. Additional cutting on national forest lands in a drainage may be halted temporarily if this evaluation indicates that a stream's hydrologic threshold will be exceeded. Over time, hydrologic conditions return to the pre-harvest balance as trees regenerate and once again play a role in interception and evapo-transpiration.

Concerns have also been expressed over the timing of spring runoff in drainages subject to intensive harvest. Studies have indicated that peak flows may come earlier from such drainages, but there has been less support in the scientific literature for the contention that late-season streamflows are reduced as a consequence of widespread clearcutting.

III. HISTORY OF FOREST PRACTICE LEGISLATION IN MONTANA

A. LEGISLATION IN THE 1970S

Efforts to regulate forest practices in Montana were initiated in 1972, with the preparation of a draft "Montana Forest Practices Act" by the Department of Natural Resources and Conservation (DNRC). The act proposed to grant DNRC authority to adopt rules setting minimum legal standards for timber harvesting, associated road construction, reforestation, use of forest chemicals, and disposal of logging slash. The department prepared a draft and final environmental impact statement on the forest practice act, conducted public hearings, and continued to move forward in preparation for the 1973 session of the Montana Legislature.

During the 1973 session, DNRC's proposal was introduced as Senate Bill 405. Following a hearing, the Senate Natural Resource Committee acted to hold over SB 405 until the 1974 legislative session. The committee directed DNRC to revise the bill and prepare for public review the specific rules that would be proposed to implement the act. In the summer following the session, Governor Tom Judge appointed a seven-member Forest Practice Advisory Council and charged the committee with recommending any necessary revisions to SB 405 and developing rules to implement a forest practices act. In 1973 DNRC again went through the environmental impact statement process, this time addressing both the act and the proposed rules.

SB 405, slightly revised to accommodate concerns about the scope of rulemaking authority, was again considered by the Legislature in 1974. This time the bill was killed on the Senate floor. Opposition centered on provisions of the bill and proposed rules that would protect scenic values; affect previously negotiated harvest operations; regulate Christmas tree plantations; and provide for a property lien to ensure rehabilitation of sites damaged by illegal forest practices.

The 1974 Legislature did pass Senate Joint Resolution 44, calling on the U.S. Congress to appropriate funds to "step up" reforestation on national forest lands and to bolster the forestry incentive program on non-federal lands. The resolution cited reforestation problems on federal lands "where inadequate reforestation has gone from bad to worse", and on private forest lands where "[a] significant portion of this land lies idle or only partly productive."

The acts proposed in Montana during 1973 and 1974 coincided with an intense period of forest practice legislation in other western states. Oregon adopted a major revision of its forestry laws in 1971; Idaho, following the Oregon model, enacted comprehensive forest practices legislation in 1974; California adopted sweeping new legislation in 1973; Nevada significantly

amended its forest practice statutes in both 1971 and 1973; and Washington passed comprehensive forest practice legislation in 1974 (Henly and Ellefson 1986). Many of these acts superseded 1940s-vintage laws that had focused primarily on reforestation. The "new wave" of forest practices acts addressed water quality, soil conservation, and wildlife habitat -- all issues of growing societal importance in the 1970s.

In 1975 Senate Bill 157 (introduced by Senators Flynn, Roskie, Fasbender, and Colberg) again proposed to allow DNRC to enforce minimum rules for timber harvest, road construction, reforestation, chemical use and slash disposal. The rulemaking authority (to be vested in the Board of Natural Resources and Conservation) was "designed to assure the continuous growing and harvesting of forest tree species and the protection and maintenance of the forest soil, air, and water resources, and wildlife and aquatic habitat" (SB 157). A Forest Practices Advisory Council would advise the board in its rulemaking deliberations. SB 157 was modeled after the Oregon and Idaho acts and did not contain the specific provisions that had contributed to the defeat of SB 405.

During its hearing before the Senate Natural Resources Committee, SB 157 drew broad-based support from the major industrial timberland owners, state and federal agencies, and environmental groups. Opposition came from small timber owners, timber operators, and some farm groups, who viewed the bill as an intrusion on private property rights. Although the committee endorsed the bill, SB 157 was killed on the Senate floor.

The 1975 Legislature did pass the Natural Streambed and Land Preservation Act, requiring approval from the local soil conservation district for any activity that would alter the bed or banks of a perennial stream. Although not specifically targeted at timber management, a major application of this law has been for stream crossings associated with forest roads.

In 1981 management of state-owned forest land, along with the Office of the State Forester, was transferred from DNRC to the Department of State Lands (DSL). With the transfer DSL also gained responsibility for administration of slash disposal laws, private forestry assistance, fire control and other elements of the state forest management program.

The defeat of SB 157 temporarily halted efforts to enact forest practice legislation in Montana. No forest practice bills were introduced during the five regular legislative sessions from 1977 through 1985.

B. HOUSE BILL 781

During the 1987 session, Representative Ben Cohen introduced House Bill 781, the "Forest Watershed Management Act." HB 781 proposed to allow private forest landowners to enter voluntarily

into "binding cooperative agreements" with the Department of State Lands. The 10-year agreements would specify acceptable management practices for watershed protection on the private forest land, and would also include monitoring and notification provisions. Landowners would receive a reduced property tax rate for forest land subject to the provisions of the agreement. The bill also authorized DSL to adopt and enforce forest practice rules, which would apply to private forest lands greater than 40 acres and not under a cooperative agreement.

In a hearing before the House Natural Resources Committee, proponents of HB 781 argued the bill was needed to protect Montana watersheds from damage by logging operations. They cited the binding cooperative agreements as a means to implement a watershed-by-watershed approach for on-site and cumulative water quality effects. They also claimed the tax reduction was an appropriate incentive for good watershed management.

Opponents questioned the need for the legislation, citing existing cooperative watershed management programs and an increased attention to water quality by Montana timber operators. They raised concerns about administrative and compliance costs that would accompany HB 781, and the potential effect of the tax provisions in reducing timber availability. Opponents also were critical that representatives of the timber industry were not consulted on the proposed legislation until just prior to introduction.

Persons testifying in opposition to HB 781 represented the timber industry, private landowners and loggers. Supporters represented environmental groups, professional biologist organizations and two state agencies. The Department of State Lands endorsed the bill's concepts of minimum standards combined with the opportunity for negotiated watershed agreements with individual landowners. DSL indicated a need for 13 new employees to administer the act, although HB 781 did not include any appropriation. The Water Quality Bureau also stated its support for HB 781.

The House Natural Resources Committee ultimately tabled HB 781 on a 10-8 vote three days after the hearing. During that executive session, however, members agreed to draft a committee resolution for an interim study of the relationship between forest practices and watershed effects in Montana. A resolution was drafted, approved by the committee, and introduced as House Joint Resolution 49 by Rep. Joan Miles, with co-sponsorship by the other 17 members of the House Natural Resources Committee.

HJR 49 received bi-partisan support from the committee and from the House of Representatives. The Senate Natural Resources Committee and the full Senate also approved the resolution. HJR 49 was signed by the Governor in April 1987.

C. HOUSE JOINT RESOLUTION 49

Introductory clauses in House Joint Resolution 49 (Appendix A) cite the economic importance of Montana's timber industry and the value of the state's forest watersheds. The resolution notes that timber harvest may affect water quality and quantity, and says there is a need to assess available information on this relationship.

The resolution lists a range of benefits that derive from the use of best management practices and mentions efforts underway by the timber industry to implement such practices. HJR 49 also cites successful efforts in Washington and Idaho to reach a consensus among various interest groups on how to meet both timber and watershed goals in forest management. The introductory clauses conclude by noting "it is desirable to draw together relevant information to assess whether administrative or legislative direction is necessary to further the use of best management practices for forestry in Montana."

In resolving to address these considerations, HJR 49 directs the Environmental Quality Council to study:

"(1) how current forest management practices are affecting watersheds in Montana;

(2) the range of management practices that have proven effective in conserving watersheds while maintaining the economic viability of timber harvest operations;

(3) the existing administrative framework, including regulatory and voluntary efforts, promoting the use of best management practices in Montana and other states; and

(4) if areas for potential improvement are indicated, the actions that would be most conducive achieving both watershed and timber goals."

The resolution also directs EQC to work closely with persons and organizations with technical expertise in timber harvest techniques and effects. EQC is to report its findings to the 51st Legislature (1989) and, if necessary, draft legislation to implement its recommendations.

IV. STUDY ORGANIZATION AND CHRONOLOGY

A. ENVIRONMENTAL QUALITY COUNCIL

The Environmental Quality Council formally began its study under House Joint Resolution 49 with a two-day meeting in western Montana on September 14-15, 1987. The first day's session, held at the University of Montana Lubrecht Experimental Forest, provided an opportunity for the Council to hear from a variety of persons experienced in forest watershed management in Montana. The agenda (see Appendix B) included a mix of presentations on technical, administrative, and legal elements encompassed by HJR 49. An initial panel on the relationship between forest practices and water quality was followed by a discussion by state, federal and local officials on how forest management activities are currently regulated in Montana. A roundtable on best management practices provided insight into what this term means in the field and the relationship between good practices and watershed condition.

In the afternoon session, Frank Gaffney of the Northwest Renewable Resources Center and Bruce Beckett of Plum Creek Timber gave a detailed presentation on Washington state's 1987 Timber/Fish/Wildlife Agreement. The agreement, which resulted from intense negotiations among the timber industry, environmentalists, Indian tribes, and state agencies, represents a landmark accommodation between the timber industry and persons concerned about the public resources affected by forest management activities. Key elements of the agreement include increased protection for fish and wildlife, formal recognition of the needs and values of the timber industry, and the development of a process called "adaptive management," through which findings in the field will be channeled back to policymakers to improve on-the-ground management. The EQC meeting concluded with a session of "Montana Perspectives" on the forest management/ watershed issue. Representatives from 15 different organizations addressed the Council, giving their views of the current situation, and advice on the appropriate direction for the HJR 49 study.

On September 15, EQC members toured the Lolo Creek watershed west of Missoula. Tour stops included discussion of management practices and objectives on federal and private lands, along with particular practices appropriate for the highly erosive soils characteristic of portions of the drainage. Tour participants also discussed in-stream sediment, its sources and its relationship to fish populations.

In October 1987 EQC staff developed and received public comments on a draft House Joint Resolution 49 study plan (Appendix C). The study plan outlined a year-long effort, involving technical specialists from various perspectives on forest watershed management, to develop the information requested in HJR 49. A Watershed Effects Working Group (WEWG) would be

appointed to assemble and review information pertinent to an assessment of the effects of forest management on Montana watersheds. A Best Management Practices Technical Committee (BMPTC) would be charged with developing a consensus list of best management practices to achieve watershed goals without unreasonably infringing upon timber harvest needs or economics.

The study plan also called for appointment by EQC of a Timber/Watershed Policy Forum, again representing various interest groups, to review the information generated and to assist in the development of policy recommendations. EQC staff would research and report on the administrative and regulatory programs promoting the use of best management practices in Montana and other states.

The Council approved the study plan with modifications at its meeting on October 22. The Council eliminated the proposed Timber/Watershed Policy Forum, noting that EQC must ultimately make the policy recommendations and that interest groups will be able to participate in all EQC decisions throughout the study. The two other technical committees were retained, and the study timetable approved.

The full Environmental Quality Council next addressed forest watershed issues at a meeting on January 29, 1988. The Council heard reports on the initial meetings of the technical committees from Rep. Bob Gilbert, chairman of the Watershed Effects Working Group, and from Rep. Hal Harper, chairman of the Best Management Practices Technical Committee. The Montana Chapter of the Wildlife Society, representing professional wildlife biologists, presented a request that EQC include wildlife within the scope of the HJR 49 study. Council members voted to add a wildlife biologist to each of the technical committees, but not to expand the scope of the study to formally include wildlife considerations. Council members generally expressed a desire to stay within the intent of the resolution and not dilute their efforts or jeopardize cooperation with HJR 49 participants by significantly expanding the study scope.

The EQC met again on April 8 and gave preliminary consideration to two forest watershed projects potentially eligible for grants under the state Renewable Resource Development (RRD) program. The Flathead Basin Forest Practices Water Quality Cooperative Program involves a multi-phase research and monitoring effort to assess the effects of forest management on water quality, water quantity, and fisheries. Private industry, the University system, and state and federal agencies cooperated in the design and funding of the project. The Environmental Quality Council was requested to consider participating as a cooperator and as a sponsor of an RRD grant application. EQC also heard an overview of a proposed Forest Practices BMP Education Project under consideration by the Department of State Lands' Division of Forestry. The Council

approved a minor commitment of EQC staff time to aid in developing RRD grant applications for the two projects.

A video on the Horse Creek watershed study in Idaho was also presented during the April meeting. This study has assessed the effects of timber harvest and road construction on water quality and water quantity over a 25-year period. A number of recommendations on management practices have been developed through the study. Reps. Gilbert and Harper updated Council members on the progress of the Watershed Effects Working Group and the Best Management Practices Technical Committee.

On June 6, EQC received a detailed report on the Forest Practices Water Quality Management Plan developed by the State of Idaho. Steve Bauer of the Idaho Water Quality Bureau explained that the plan responds to the requirements of the federal Clean Water Act to prevent nonpoint source water pollution. He described various elements of the Idaho plan, including notification prior to logging, prioritized inspections of sensitive watersheds, training and education, and evaluation and revision of best management practices through a "feedback loop". Bauer noted the difficulties of using water quality data to define the effects of specific forest practices and the need to develop monitoring criteria that indicate when beneficial uses of water (such as fisheries) are being damaged.

Don Jones, chief forester for the Idaho Department of Lands, outlined the operation of the Idaho Forest Practices Act, which gives his department responsibility for overseeing and enforcing minimum management practices on state and private forest lands. Jones said state resources directed to forest practice act implementation have fluctuated greatly in recent years, but the state is now committing $542,000 to fund a 13-person forest practices program. About 30% of this funding is provided from a five cent per acre assessment on private forest land. Jones recommended that Montana begin with a set of reasonable BMPs, perhaps on a voluntary basis, to gain public support for the concept. Bauer commented that at some point enforcement needs to be included along with information and education programs.

Also during the June 6 meeting EQC heard more detail about the two RRD grant applications. Flathead National Forest Supervisor Edgar Brannon explained the Flathead Basin cooperative program, and State Forester Gary Brown presented his agency's proposed BMP education project, a two-year effort to promote the use of best management practices on private forestry operations in Montana. EQC endorsed the projects. (Sponsorship of the Flathead RRD grant application was later transferred to the Flathead Basin Commission, while DSL retained sponsorship of the BMP education project.)

Rep. Gilbert reported on the efforts of the Watershed Effects Working Group to gather information on forest watershed impacts. The committee resolved to develop a questionnaire for

distribution to natural resource professionals and to conduct on-site surveys of randomly selected timber sales across Montana. Rep. Harper reported that the Best Management Practices Technical Committee had reached agreement on most issues, with additional work to be completed on riparian management, chemical use, and winter logging.

On July 14 several representatives of the Environmental Quality Council participated in day-long tour of logging operations in the Swan River drainage. The tour, organized by the Montana Cumulative Watershed Effects Cooperative, visited recent logging operations illustrating management issues related to stream crossings, cumulative watershed analysis, and riparian zones.

The Environmental Quality Council convened in Missoula on September 28 for a combined one-day meeting and tour on forest watershed issues. The meeting began with a panel composed of a participant from each of the three field teams that conducted the HJR 49 inventory of management practices at 38 timber sales in Montana. Panelists gave their perspectives on the field assessments, reviewing the level of compliance with best management practices and highlighting some of the specific management practices that were appropriately or inappropriately applied.

During a second panel, titled "Program Options for the Control of Nonpoint Source Pollution from Forest Practices in Montana", state and local government officials offered ideas on how to develop a more effective forest watershed program. State Forester Gary Brown advocated designation of the Department of State Lands as the lead agency for implementing Montana's nonpoint pollution control program for forest management. Brown noted that DSL has forestry expertise and, because of existing slash disposal laws, is the point of contact for private forest owners. He said additional resources would be necessary for DSL to carry out necessary training, education, and oversight responsibilities. Wally Congdon of the Missoula Conservation District said that local officials are in a good position to participate in non-regulatory oversight of forest practices, but local programs need to be bolstered through financial and technical assistance. Steve Pilcher, chief of the Water Quality Bureau, reviewed a decade of federal guidance and state responses for nonpoint pollution control programs under the Clean Water Act. He said although conservation districts are the designated agency for nonpoint pollution, financial support continues to be the "missing link" in program implementation.

Rep. Harper gave an update on the September 23 meeting of the Best Management Practices Technical Committee, which focused on streamside management issues. The EQC session on HJR 49 concluded with Council consideration of an outline and timetable for the draft and final reports.

The Environmental Quality Council met again on October 28 for consideration of a preliminary draft of the HJR 49 report. Staff researcher Hugh Zackheim presented preliminary study findings and Council members discussed the range of response options for further consideration.

The draft HJR 49 report was completed and distributed to a mailing list of about 300 persons on November 7. On December 9, the Environmental Quality Council met in Helena to receive public comment on the report (Appendix K), consider response options, and develop recommendations for six specific elements of a state forest practices water quality program. The recommendations resulting from these EQC deliberations are presented in Chapter IX.

B. TECHNICAL COMMITTEES

Following Council approval of the HJR 49 study plan in October 1987, EQC distributed a questionnaire soliciting public interest in serving on the Watershed Effects Working Group and the Best Management Practices Technical Committee, the two committees intended to assist EQC in developing information. In November EQC Chairman Sen. Mike Halligan and Vice Chair Rep. Bob Gilbert appointed a total of 36 persons to the two committees, drawing from a list of about 45 names. The committees included a cross section of representatives from the timber industry, state and federal agencies, private landowners and timber operators, and conservation groups (Appendix D). As specified in HJR 49, members selected to serve on the committees had "technical expertise in timber harvest techniques and effects."

1. Watershed Effects Working Group

The Watershed Effects Working Group (WEWG) held its first meeting on December 11, 1987. Chairman Rep. Bob Gilbert explained that the committee's primary objective was to assemble and review information pertinent to an assessment of the effects of forest practices on Montana watersheds. Possible approaches to this task were presented, as outlined in the HJR 49 study plan.

Committee members discussed the available information sources, concluding that there is neither a uniform data base for forest water quality in Montana nor a standardized method of using water quality measurements to determine forest management impacts. Forest watershed are characterized by considerable natural variability in climate, runoff, sediment transport, and fish and aquatic insect populations, factors which make it difficult to monitor or evaluate the environmental effects of forest management. Activities in headwater areas may exhibit their effects (e.g., sediment deposition) in downstream reaches, further complicating evaluations. Watershed effects may also be delayed considerably from the causative forest practices; for

example, sedimentation may not occur until runoff from a major storm event erodes exposed soils and carries them into a stream.

To overcome difficulties in directly assessing forest management/water quality impacts, WEWG members discussed the idea of surveying management practices on a random sample of timber sales in Montana. The surveys would be based on professional judgment and would attempt to determine the types and frequency of forest practices causing water quality impacts. Focusing on management practices, rather than water quality data, would eliminate the difficulty of defining a threshold for damage to water quality or aquatic resources. The Idaho Silvicultural Nonpoint Source Task Force report (Idaho 1985) was cited as an example of the timber sale evaluation process.

WEWG members also discussed cumulative watershed effects, the manner in which multiple timber management activities in a drainage can together cause stream sedimentation and increase water yield. Although current capabilities for watershed modeling and predicting cumulative effects are not very precise, it was considered unrealistic to expect the HJR 49 study to improve basic knowledge in this area. The Montana Cumulative Watershed Effects Cooperative under the auspices of the State Forester was cited as an appropriate forum for attempting to define and resolve these management issues.

The second WEWG meeting was held on February 23. Prior to the meeting, committee members had received and responded to a detailed survey from EQC staff requesting ideas on methods to obtain information to meet the committee's charge.

Committee members expressed strong support for conducting field surveys to evaluate the effects of timber management practices. Discussion centered on whether the field surveys should focus on individual timber sales or entire watersheds. Some committee members indicated that observations of stream condition, coupled with a review of management history and on-site practices, could indicate how timber management was affecting a small watershed. Others said it would be difficult to reach a consensus attributing stream condition to timber management activities. These members advocated limiting the field surveys to an evaluation of management practices at individual timber sales. A subcommittee was appointed to resolve the issue of field surveys.

a. Questionnaire:

The WEWG endorsed the development of a questionnaire to poll natural resource professionals on their knowledge of the watershed effects of specific forest practices in Montana. A subcommittee was appointed to work out details of the questionnaire and its distribution. This subcommittee met on March 9 and reached general agreement on the contents of the questionnaire. The questionnaire would solicit information about

"problem sites", where forest practices caused watershed damage, and about "model sites", where good management practices prevented damage in drainages with high erosion hazards or sensitive environmental values. Responses to these topics would assist EQC in its charge to assess watershed impacts and to develop effective management practices.

A preliminary draft of the questionnaire was developed and submitted to the full WEWG at its April 12 meeting. Initial comments were incorporated and, a second draft was developed and distributed for review by the committee membership before the text was finalized.

The final form of questionnaire and accompanying instruction sheet (Appendix E) reflected the committee's desire to obtain credible, site-specific information about management practices and their effects. In Part I (watershed damage caused by forest practices), respondents were asked to indicate timber sale location, the nature and severity of damage observed, and the relative contribution of natural erosion and non-forestry land uses to the problem. A list of 15 potential departures from best management practices was provided, and respondents were asked to specify the departures contributing to watershed damage at the site. The questionnaire requested information only on forest practices conducted during the past five years. In Part II (model timber sales), respondents were asked to describe the sensitive environmental values, erosion hazards, and innovative or best management practices used to conserve watershed resources.

The questionnaire was mailed in late June, with a requested response date of August 31. Distribution was to the Montana membership of the Society of American Foresters, American Fisheries Society, American Water Resources Assn., and the Wildlife Society; Department of State Lands Division of Forestry; the U.S. Forest Service; Conservation District supervisors; Indian tribal governments; Montana Wood Products Assn.; Montana Logging Assn.; Montana Tree Farmers Assn.; the Water Quality Bureau, and consulting foresters in Montana. This distribution includes forest/watershed specialists and the major forest land managers, and encompasses the range of experiences with management practices and watershed conditions across Montana. About 900 questionnaires were mailed.

b. Timber Sale Audits:

The subcommittee developing field survey techniques met on March 8. Members generally agreed that evaluating on-site management practices at timber sales would be the best method to obtain objective data on forest practices in Montana. The survey would meet two objectives of HJR 49: determining the degree that best management practices are used in Montana and assessing the effectiveness of current practices in protecting watershed values.

A survey would also avoid problems inherent in other approaches. For example, reviewing existing forest water quality data in Montana would have little benefit because agency monitoring programs have generally not been designed (or carried out long enough) to clearly define harvest impacts. Similarly, it is difficult to use field assessments to determine the cause-and-effect relationship between timber management and water quality or stream condition (NCASI 1988).

The subcommittee's proposal was brought before the full Watershed Effects Working Group and discussed during the group's third meeting on April 12. Ultimately, the following procedures and criteria were agreed upon for the timber sales to be audited:

* the timber sale was harvested in 1986, with slash disposal completed by the audit date;

* more than 50,000 board-feet of timber was harvested;

* at least a portion of the sale must be located within 200 feet of a perennial or intermittent stream channel;

* sales occurring on high-hazard land types (steep slopes and erosive soils) should comprise the majority of the audits;

* the distribution of sales audited should generally reflect the distribution of timber harvest in Montana;

* sites would be classified by four land ownership classes, representing nonindustrial private, industrial private, federal and state forest lands;

* the focus of the audits should be on private lands, particularly industrial private because of their relatively high proportion of harvest volume, but state and federal practices also need to be evaluated; and

* timber sales would be evaluated based on the degree to which best management practices were used and were effective in protecting water quality. Audit teams would use a form developed by the DSL Division of Forestry that provides for the evaluation of 36 separate management practices.

This combination of procedures and criteria focused on recent timber sales that have the potential to impact watersheds and that are representative of timber management activity in Montana. Lists of Department of State Lands timber sales were obtained from the DSL Division of Forestry, and small private sales were drawn from DSL's file of hazard (slash) reduction agreements. Names and locations of industrial private timber sales were taken from the master hazard agreements between DSL

and Plum Creek Timber Company and between DSL and Champion International. Additional names of sales meeting the audit criteria were provided by the companies on request. Lists of federal sales meeting the criteria were provided by the Forest Service and the Missoula District of the Bureau of Land Management. From each ownership category, sales meeting the audit criteria were placed in a "pool". The sales to be audited were randomly selected from each pool.

The Environmental Quality Council appointed three 5-member regional timber sale audit teams to conduct the audits. A one-day "calibration" audit was held on July 11 at two timber sales in the Missoula area. At this time members of all teams assembled to become familiar with the audit form and evaluation procedures. The first of the 38 field audits began on July 15; the last audit was completed on September 2. Appendix F lists the audit schedule and timber sale locations, and team composition.

2. Best Management Practices Technical Committee

The Best Management Practices Technical Committee (BMPTC) held its initial meeting on December 16, 1987. Chairman Rep. Hal Harper stated the committee's primary goal as developing a consensus set of best management practices (BMPs) that meet the needs of Montana's water quality and timber industry. The committee would review the BMP lists being used in Montana and other jurisdictions, identify consensus BMPs, and highlight any unresolved policy issues.

Initial committee discussion focused on the meaning of the term "best management practices" and on the administrative structure in Montana promoting the use of BMPs. Committee members noted that BMPs are not necessarily the best practices, but the minimum standard of operation to conserve soil and water resources. BMPs need to be applied on a preventative basis, beginning with the sale layout. Committee members favored flexibility in the wording of practices to allow operators to react to the site conditions in the best manner for both timber and watershed values. However, some commented that specific language may be necessary so that operators know what they are expected to do and to provide protection for streamside zones and other sensitive sites. Members suggested that the BMPs developed by the Cumulative Watershed Effects Cooperative would be an appropriate starting place for the committee's efforts to develop consensus BMPs.

Additional topics covered during the first meeting included a review of state, federal and private BMP programs; the need for clear BMPs that can be readily understood by small private landowners and operators; and specific problems with management practices, including seeding of exposed soils, supplying adequate drainage during road pioneering, and the importance of proper road location. The meeting closed with general discussion of the

relevance of water quality monitoring to evaluate management practices and the need for additional educational programs to promote BMPs.

Following the initial meeting of the BMPTC, EQC staff prepared and distributed to committee members a survey requesting input on recommended BMPs from Montana and other western states. Members were also sent complete BMP rules from Oregon, Washington, Idaho, and the U.S. Forest Service, along with BMPs from the Montana Cumulative Watershed Effect Cooperative and the 1978 statewide Section 208 report on water quality planning for forest management.

The survey responses were utilized during the second committee meeting on February 26, 1988, as the committee members spent about five hours working their way through a complete BMP package. Major topics included roads (location, design, drainage, construction and maintenance), timber harvesting, and site preparation.

A revised set of BMPs was mailed out for review on April 15, and on April 26 the committee reconvened to give additional consideration to proposed language and changes in organizational structure, including a new section focusing on the "310" stream-crossing permit. During a six-hour session, most issues were resolved, with the exception of final language for winter logging and hazardous substances (new BMP sections suggested by the committee) and streamside management, which was to be addressed at a separate meeting.

Following a summer taken up by the timber sale audits (in which a number of BMPTC members participated), the committee met on September 23 to address streamside management BMPs. Background materials provided in advance of the meeting included a summary of streamside management BMPs from other jurisdictions (Appendix G) and streamside guidelines from the Department of State Lands. The BMPs developed for streamside zones are described in section C. of chapter V. of this report.

The committee also reviewed a revised version of the entire BMP package, which incorporated comments on the previous draft. An October 13 draft of "Best Management Practices for Forestry in Montana", including the language and definitions developed for streamside management zones, was subsequently developed and is included in this report (Appendix H).

V. FINDINGS

As outlined in Chapter IV, the research conducted under House Joint Resolution 49 took a variety of forms. One effort, the audits of timber sales, generally followed the model for scientific research (field studies of randomly selected sites), but the ratings necessarily depended on professional judgment rather than measurement of variables. For other study topics, information was generated through a mix of interviews, technical committee discussions, presentations at EQC meetings, field trips, and literature research.

The findings reported in this section, then, represent several distinct research approaches carried out with the assistance of many study participants. Findings are organized into the categories defined by HJR 49: watershed effects, best management practices, and administrative framework governing forest practices.

The HJR 49 study did not include a detailed review of the scientific literature on forest practices and watershed effects. Pertinent findings from past research are well summarized in a variety of sources that were used in the preparation of this report; consequently, the HJR 49 study was organized to work through technical committees, field audits and other information-producing forums to gain a better understanding of Montana conditions, perspectives and programs. Members of the technical committees and other study participants did assist in locating a number of important publications that were used in the development of this report.

The HJR 49 study also did not include a summary or compilation of existing forest water quality data from Montana watersheds. Such a data review was judged to have little practical value because of the variety of monitoring strategies and objectives, the incompatibility of data from different monitoring programs, and a general lack of long-term monitoring that could shed light on the relationships between forest practices and water quality.

A. WATERSHED EFFECTS

1. Timber Sale Audits

The three regional teams audited a total of 38 timber sales in four different ownership classes (Table 1). (See Appendix F for audit dates, locations and team members and see page 21 for discussion of the methods and criteria used to select audit sites.)

TABLE 1. OWNERSHIP AND REGIONAL DISTRIBUTION OF TIMBER SALES AUDITED

	REGION			
OWNERSHIP	Southwest	West Central	Northwest	Total
IPF	5	5	6	16
NIPF	5	2	1	8
State	0	2	3	5
Federal	3	3	3	9
Total	13	12	13	38

IPF -- Industrial private forest (Plum Creek and Champion)
NIPF -- Nonindustrial private forest
State -- State-owned lands (Department of State Lands)
Federal -- Forest Service (8 sales)/Bureau of Land Management (1 sale)

On each audit, 36 management practices were evaluated for both application (the degree to which the practice was applied) and effectiveness (the degree to which the practice was effective in preventing the movement of soil into surface waters), using a form developed by the Department of State Lands (Appendix I). The form thus yielded a maximum of 72 individual ratings for each sale, but many practices were not applicable for every sale. For example, practices relating to road construction were not evaluated for sales that utilized existing roads only. Audit teams completed a single form for each timber sale, and each numerical rating was derived through a consensus of all team members. The combined results of the audit are presented in Table 2.

In total 925 ratings were given for the application of best management practices in the 38 audits (an average of about 24 practices rated per audit). One percent of the practices exceeded the specifications for the best management practices (BMP); 82% met BMP specifications; 14% showed minor departures; and 5% were rated as major departures. Only one instance was rated as "gross neglect" by the audit teams.

Nine hundred and twenty-five ratings were also given for the effectiveness of the practices in preventing the movement of soil into streams. Less than 1% of the practices were considered to be improvements over pre-existing conditions; 84% of the practices were rated as adequate; 13% were judged to cause minor and/or temporary detrimental impacts; 3% were rated as causing major detrimental impacts, primarily short-term; and less than 1% of the practices were judged to be having major detrimental impacts on resources, with extensive damage and long-term recovery.

TABLE 2: TIMBER SALE AUDIT RESULTS

Notes:

(1) Appendix I is a copy of the audit form, which includes more detailed descriptions of the management practices evaluated.
(2) Abbreviations:
BMP -- Best management practices
FED -- Federal lands
IPF -- Industrial private forest
NIPF -- Nonindustrial private forest
SMZ -- Streamside management zone
(3) Application Ratings:
1 - Gross neglect of BMP
2 - Major departure from BMP
3 - Minor departure from BMP
4 - Meets requirements of BMP
5 - Exceeds requirements of BMP
(4) Effectiveness Ratings:
1 - Major detrimental impacts on soil and water resources; damage extensive, recovery expected to be slow
2 - Major detrimental impacts, primarily short-term
3 - Minor and/or temporary impacts on soil/water resources;
4 - Adequate protection of soil and water resources
5 - Improved protection of resources over pre-project condit'n

BMP	OWNERSHIP	APPLICATION 1	2	3	4	5	EFFECTIVENESS 1	2	3	4	5
ROADS -- Planning											
1. Minimize Number of Roads	**ALL**	**0**	**1**	**5**	**22**	**1**	**0**	**0**	**4**	**24**	**1**
	NIPF	0	0	2	6	0	0	0	1	7	0
	IPF	0	1	0	11	0	0	0	1	11	0
	STATE	0	0	1	3	0	0	0	1	3	0
	FED	0	0	2	2	1	0	0	1	3	1
2. Approp. Standards	**ALL**	**0**	**0**	**3**	**22**	**0**	**0**	**0**	**3**	**22**	**0**
	NIPF	0	0	0	7	0	0	0	1	6	0
	IPF	0	0	2	7	0	0	0	1	8	0
	STATE	0	0	0	2	0	0	0	0	2	0
	FED	0	0	1	6	0	0	0	1	6	0

TABLE 2: TIMBER SALE AUDIT RESULTS

BMP	OWNERSHIP	APPLICATION 1	2	3	4	5	EFFECTIVENESS 1	2	3	4	5
3. Avoid Hazards	**ALL**	**0**	**0**	**3**	**28**	**0**	**0**	**0**	**2**	**29**	**0**
	NIPF	0	0	0	6	0	0	0	0	6	0
	IPF	0	0	2	11	0	0	0	2	11	0
	STATE	0	0	0	5	0	0	0	0	5	0
	FED	0	0	1	6	0	0	0	0	7	0
4. Adequate SMZ Provided	**ALL**	**0**	**1**	**1**	**25**	**0**	**1**	**0**	**1**	**25**	**0**
	NIPF	0	0	0	6	0	0	0	0	6	0
	IPF	0	1	0	9	0	1	0	0	9	0
	STATE	0	0	0	3	0	0	0	0	3	0
	FED	0	0	1	7	0	0	0	1	7	0
5. Permits Obtained	**ALL**	**0**	**0**	**0**	**7**	**0**	**0**	**0**	**0**	**7**	**0**
	NIPF	0	0	0	1	0	0	0	0	1	0
	IPF	0	0	0	1	0	0	0	0	1	0
	STATE	0	0	0	1	0	0	0	0	1	0
	FED	0	0	0	4	0	0	0	0	4	0
6. Avoid Long Steep Grades	**ALL**	**0**	**0**	**0**	**25**	**0**	**0**	**0**	**0**	**25**	**0**
	NIPF	0	0	0	5	0	0	0	0	5	0
	IPF	0	0	0	10	0	0	0	0	10	0
	STATE	0	0	0	3	0	0	0	0	3	0
	FED	0	0	0	7	0	0	0	0	7	0
7. Minimize Number of Xings	**ALL**	**0**	**0**	**0**	**26**	**0**	**0**	**0**	**0**	**26**	**0**
	NIPF	0	0	0	5	0	0	0	0	5	0
	IPF	0	0	0	11	0	0	0	0	11	0
	STATE	0	0	0	4	0	0	0	0	4	0
	FED	0	0	0	6	0	0	0	0	6	0
ROADS -- Drainage											
1. Adequate Drainage	**ALL**	**0**	**3**	**10**	**18**	**1**	**0**	**3**	**9**	**20**	**0**
	NIPF	0	1	3	3	0	0	1	3	3	0
	IPF	0	2	2	9	1	0	1	4	9	0
	STATE	0	0	1	2	0	0	0	1	2	0
	FED	0	0	4	4	0	0	1	1	6	0

TABLE 2: TIMBER SALE AUDITT RESULTS

BMP	OWNERSHIP	APPLICATION 1	2	3	4	5	EFFECTIVENESS 1	2	3	4	5
2. Timely Install.	**ALL**	**0**	**1**	**2**	**19**	**0**	**0**	**0**	**4**	**18**	**0**
	NIPF	0	0	2	2	0	0	0	2	2	0
	IPF	0	0	0	8	0	0	0	0	8	0
	STATE	0	0	0	4	0	0	0	0	4	0
	FED	0	1	0	5	0	0	0	2	4	0
3. Drainage Thru SMZ	**ALL**	**0**	**3**	**3**	**9**	**0**	**0**	**2**	**4**	**9**	**0**
	NIPF	0	0	1	0	0	0	0	0	1	0
	IPF	0	1	0	6	0	0	1	0	6	0
	STATE	0	0	0	2	0	0	0	0	2	0
	FED	0	2	2	1	0	0	1	4	0	0
4. Proper Xing Installation	**ALL**	**0**	**0**	**2**	**11**	**1**	**0**	**1**	**1**	**11**	**1**
	NIPF	0	0	1	3	0	0	1	0	3	0
	IPF	0	0	0	2	0	0	0	0	2	0
	STATE	0	0	0	2	1	0	0	0	2	1
	FED	0	0	1	4	0	0	0	1	4	0
ROADS -- Construction											
1. Stable Cut/ Fill Slopes	**ALL**	**0**	**1**	**5**	**14**	**0**	**0**	**1**	**3**	**16**	**0**
	NIPF	0	0	2	2	0	0	0	1	3	0
	IPF	0	1	2	6	0	0	1	2	6	0
	STATE	0	0	0	1	0	0	0	0	1	0
	FED	0	0	1	5	0	0	0	0	6	0
2. Halt When Wet	**ALL**	**0**	**0**	**0**	**16**	**0**	**0**	**0**	**0**	**16**	**0**
	NIPF	0	0	0	7	0	0	0	0	7	0
	IPF	0	0	0	6	0	0	0	0	6	0
	STATE	0	0	0	1	0	0	0	0	1	0
	FED	0	0	0	2	0	0	0	0	2	0
3. Erosion Control Kept Current	**ALL**	**0**	**2**	**3**	**13**	**0**	**0**	**0**	**5**	**13**	**0**
	NIPF	0	0	1	0	0	0	0	1	0	0
	IPF	0	1	1	6	0	0	0	2	6	0
	STATE	0	1	0	2	0	0	0	1	2	0
	FED	0	0	1	5	0	0	0	1	5	0

TABLE 2: TIMBER SALE AUDIT RESULTS

BMP	OWNERSHIP	APPLICATION 1	2	3	4	5	EFFECTIVENESS 1	2	3	4	5
4. Clear Veg. From Road-fill	**ALL**	**0**	**0**	**0**	**15**	**0**	**0**	**0**	**0**	**15**	**0**
	NIPF	0	0	0	3	0	0	0	0	3	0
	IPF	0	0	0	6	0	0	0	0	6	0
	STATE	0	0	0	0	0	0	0	0	0	0
	FED	0	0	0	6	0	0	0	0	6	0
5. Overburden Placement	**ALL**	**0**	**1**	**3**	**11**	**0**	**0**	**2**	**3**	**10**	**0**
	NIPF	0	0	1	1	0	0	0	1	1	0
	IPF	0	1	2	3	0	0	2	1	3	0
	STATE	0	0	0	1	0	0	0	0	1	0
	FED	0	0	0	6	0	0	0	1	5	0
6. Timely Seeding	**ALL**	**0**	**2**	**4**	**9**	**0**	**0**	**2**	**6**	**7**	**0**
	NIPF	0	1	1	0	0	0	1	1	0	0
	IPF	0	1	2	3	0	0	1	4	1	0
	STATE	0	0	0	1	0	0	0	0	1	0
	FED	0	0	1	5	0	0	0	1	5	0
ROADS -- Maintenance											
1. Road Grading	**ALL**	**0**	**3**	**10**	**17**	**1**	**0**	**0**	**8**	**22**	**1**
	NIPF	0	0	2	2	0	0	0	3	1	0
	IPF	0	2	5	8	0	0	0	3	12	0
	STATE	0	1	2	3	0	0	0	1	5	0
	FED	0	0	1	4	1	0	0	1	4	1
2. Functional Culverts and Ditches	**ALL**	**0**	**1**	**9**	**15**	**0**	**0**	**2**	**6**	**17**	**0**
	NIPF	0	1	0	1	0	0	1	0	1	0
	IPF	0	0	6	8	0	0	1	5	8	0
	STATE	0	0	1	2	0	0	0	0	3	0
	FED	0	0	2	4	0	0	0	1	5	0
3. Avoid Toe-Slope Cuts	**ALL**	**0**	**0**	**2**	**20**	**0**	**0**	**0**	**2**	**20**	**0**
	NIPF	0	0	1	1	0	0	0	1	1	0
	IPF	0	0	1	10	0	0	0	1	10	0
	STATE	0	0	0	3	0	0	0	0	3	0
	FED	0	0	0	6	0	0	0	0	6	0

TABLE 2: TIMBER SALE AUDIT RESULTS

BMP	OWNERSHIP	APPLICATION 1	2	3	4	5	EFFECTIVENESS 1	2	3	4	5
4. Drainage for Closed Roads	**ALL**	**0**	**4**	**8**	**9**	**1**	**0**	**2**	**10**	**9**	**1**
	NIPF	0	1	3	0	1	0	0	4	0	1
	IPF	0	1	3	8	0	0	1	4	7	0
	STATE	0	1	0	0	0	0	0	1	0	0
	FED	0	1	2	1	0	0	1	1	2	0
5. Restrict Wet-Period Use	**ALL**	**0**	**0**	**2**	**24**	**0**	**0**	**0**	**1**	**25**	**0**
	NIPF	0	0	0	4	0	0	0	0	4	0
	IPF	0	0	1	11	0	0	0	1	11	0
	STATE	0	0	1	3	0	0	0	0	4	0
	FED	0	0	0	6	0	0	0	0	6	0
TIMBER HARVEST											
1. Adequate SMZ	**ALL**	**1**	**7**	**6**	**23**	**2**	**3**	**4**	**7**	**24**	**1**
	NIPF	0	2	2	6	0	1	1	2	6	0
	IPF	0	4	3	8	1	2	2	3	9	0
	STATE	0	0	0	4	1	0	0	0	4	1
	FED	1	1	1	5	0	0	1	2	5	0
2. Streams Free of Debris	**ALL**	**0**	**4**	**10**	**23**	**0**	**1**	**2**	**9**	**25**	**0**
	NIPF	0	1	3	4	0	1	0	2	5	0
	IPF	0	2	3	10	0	0	1	4	10	0
	STATE	0	0	1	4	0	0	0	1	4	0
	FED	0	1	3	5	0	0	1	2	6	0
3. Avoid Equip. in Wet Areas	**ALL**	**0**	**5**	**6**	**18**	**0**	**1**	**0**	**7**	**21**	**0**
	NIPF	0	0	2	2	0	0	0	1	3	0
	IPF	0	4	2	7	0	1	0	4	8	0
	STATE	0	0	1	3	0	0	0	1	3	0
	FED	0	1	1	6	0	0	0	1	7	0

TABLE 2: TIMBER SALE AUDIT RESULTS

BMP	OWNERSHIP	APPLICATION 1	2	3	4	5	EFFECTIVENESS 1	2	3	4	5
4. Minimize Skid Disturb.	**ALL**	**0**	**1**	**0**	**34**	**1**	**0**	**1**	**0**	**35**	**0**
	NIPF	0	1	0	6	0	0	1	0	6	0
	IPF	0	0	0	16	0	0	0	0	16	0
	STATE	0	0	0	5	0	0	0	0	5	0
	FED	0	0	0	7	1	0	0	0	8	0
5. Minimize Skid Compact.	**ALL**	**0**	**0**	**0**	**36**	**0**	**0**	**0**	**0**	**36**	**0**
	NIPF	0	0	0	7	0	0	0	0	7	0
	IPF	0	0	0	16	0	0	0	0	16	0
	STATE	0	0	0	5	0	0	0	0	5	0
	FED	0	0	0	8	8	0	0	0	8	0
6. Adeq. Water Bars on Skid Trails/ Fire Lane	**ALL**	**0**	**2**	**8**	**19**	**0**	**1**	**0**	**8**	**20**	**0**
	NIPF	0	1	2	2	0	0	0	4	1	0
	IPF	0	0	3	9	0	0	0	3	9	0
	STATE	0	0	0	5	0	0	0	0	5	0
	FED	0	1	3	3	0	1	0	1	5	0
7. Landing Size and Location	**ALL**	**0**	**0**	**4**	**33**	**0**	**0**	**0**	**5**	**32**	**0**
	NIPF	0	0	0	8	0	0	0	1	7	0
	IPF	0	0	3	13	0	0	0	3	13	0
	STATE	0	0	1	4	0	0	0	1	4	0
	FED	0	0	0	8	0	0	0	0	8	0
8. Logging System	**ALL**	**0**	**0**	**2**	**35**	**1**	**0**	**0**	**1**	**37**	**0**
	NIPF	0	0	0	8	0	0	0	0	8	0
	IPF	0	0	1	15	0	0	0	0	16	0
	STATE	0	0	0	5	0	0	0	0	5	0
	FED	0	0	1	7	1	0	0	1	8	0
9. Waste Disposal	**ALL**	**0**	**1**	**4**	**32**	**0**	**0**	**1**	**2**	**34**	**0**
	NIPF	0	1	0	7	0	0	1	0	7	0
	IPF	0	0	2	14	0	0	0	0	16	0
	STATE	0	0	0	5	0	0	0	0	5	0
	FED	0	0	2	6	0	0	0	2	6	0

TABLE 2: TIMBER SALE AUDIT RESULTS

BMP	OWNERSHIP	APPLICATION 1	2	3	4	5	EFFECTIVENESS 1	2	3	4	5
10. Restrict Season of Use	**ALL**	**0**	**0**	**2**	**19**	**1**	**0**	**0**	**2**	**20**	**0**
	NIPF	0	0	0	5	0	0	0	0	5	0
	IPF	0	0	1	8	0	0	0	1	8	0
	STATE	0	0	0	3	1	0	0	0	4	0
	FED	0	0	1	3	0	0	0	1	3	0
TREATMENT AND SITE PREPARATION											
1. Use of Brush Blades on Dozers	**ALL**	**0**	**0**	**0**	**25**	**0**	**0**	**0**	**0**	**25**	**0**
	NIPF	0	0	0	4	0	0	0	0	4	0
	IPF	0	0	0	12	0	0	0	0	12	0
	STATE	0	0	0	3	0	0	0	0	3	0
	FED	0	0	0	6	0	0	0	0	6	0
2. Approp. Scarification	**ALL**	**0**	**0**	**4**	**23**	**0**	**0**	**0**	**1**	**26**	**0**
	NIPF	0	0	0	2	0	0	0	0	2	0
	IPF	0	0	2	10	0	0	0	0	12	0
	STATE	0	0	0	4	0	0	0	0	4	0
	FED	0	0	2	7	0	0	0	1	8	0
3. Oper. on Dry Soils	**ALL**	**0**	**1**	**4**	**22**	**0**	**0**	**1**	**2**	**24**	**0**
	NIPF	0	0	1	5	0	0	0	1	5	0
	IPF	0	1	3	7	0	0	1	1	9	0
	STATE	0	0	0	4	0	0	0	0	4	0
	FED	0	0	0	6	0	0	0	0	6	0
4. Dozer Use on Suitable Slopes	**ALL**	**0**	**0**	**1**	**27**	**0**	**0**	**0**	**1**	**27**	**0**
	NIPF	0	0	0	4	0	0	0	0	4	0
	IPF	0	0	0	12	0	0	0	0	12	0
	STATE	0	0	0	4	0	0	0	0	4	0
	FED	0	0	1	7	0	0	0	1	7	0
	TOTAL	**1**	**44**	**126**	**744**	**10**	**7**	**24**	**117**	**772**	**5**
	PERCENT	**<1**	**5**	**14**	**80**	**1**	**<1**	**3**	**13**	**83**	**<1**

Ratings for BMP application and effectiveness were also tabulated on a per-sale basis. Of the 38 sales audited, 20 had at least one major departure in BMP application and 16 had at least one rating indicating major detrimental impacts on water resources, including 5 sales rated as having extensive, long-term impacts.

To assess problem frequency within the different ownership classes, ratings that indicated major departures or gross neglect in BMP application (i.e., ratings 2 and 1) were summed by ownership class and divided by the number of sales audited within that ownership class. The resulting ratios give an index of the number of significant problems per sale. Industrial private timber sales received 23 significant problem ratings on a total of 16 sales audited, for a ratio of 1.4 per sale. The nonindustrial private ratio was 1.3 (10 significant problems for the 8 sales audited); federal lands had a ratio of 1.0 (9 problems for 9 sales); and state lands had a 0.6 ratio (3 problems on 5 sales). In terms of major impacts on water resources, industrial private averaged 1.0 instances per sale; nonindustrial private averaged 1.1; and federal averaged 0.7. No major impacts were noted during audits on state lands.

Minor departures from BMPs (and, in parentheses, minor impacts on water resources) exhibited a distribution of 3.9 (3.2) per sale for audits of federal sales; 3.5 (3.5) per sale for nonindustrial private; 3.3 (3.1) for industrial private; and 1.8 (1.6) for state lands.

In evaluating this data, it is worth noting that industrial private operations generally covered larger areas and removed more timber than sales within the other ownership classes. Thus, the probability that something would go wrong on a particular sale may be considered greater. There was also variation in the sensitivity of the timber sales sites and the intensity of the management activities. The five timber sales on state lands, which fared best in the ratings, were all on gradual slopes; only two had moderately erosive soils; and only two had any new road construction, both minor amounts.

The results cited above represent only a few examples of a variety of possible analyses of the data presented in Table 2. These particular results are presented here, however, because they illustrate three trends that generally characterized the audit findings. First, the frequency of major BMP departures per sale was relatively low -- averaging 1.2 per timber sale. Second, virtually all sales exhibited a number of minor departures from best management practices. Third, there was a considerable degree of consistency in problem frequency among the different ownerships, with the exception of state lands.

The frequency of problems did, however, vary greatly among specific management practices. The audit teams found that the requirement for an adequate streamside management zone (SMZ) had

the lowest overall ratings for both application of management practices and effectiveness of water quality protection. Eight of the 38 timber sales had major departures in this rating category (21%), while another six sales (16%) exhibited minor departures. The audit teams judged that seven sales (18%) would have major detrimental impacts because of streamside management practices, including three sales (8%) where the damage was characterized as extensive and long-term.

Two ratings on SMZ adequacy were given for two audits where distinctly different management practices occurred along separate streams. Each time such a split rating was given, one stream on a sale area was given adequate protection, while management along the other stream represented a major departure in BMP application and effectiveness.

Keeping streams free of logging debris, another BMP related to streamside management, was also subject to implementation problems, with 10 minor departures and 4 major departures in 37 ratings.

It is important to note that the audit teams did not downgrade streamside management practices simply because timber harvesting and related activities occurred in the streamside zone. The BMPs do not require the exclusion of activity within the zone, but rather call for careful management to protect soil and water resources. As a result, the teams developed the ratings based on the degree to which timber harvesting practices in the SMZ were designed to keep sediment out of streams and protect the integrity of streambanks and beds. The effectiveness ratings for the SMZs also bear out the fact that sales downgraded for management practices were in fact judged to be causing detrimental impacts to water quality.

Specific activities cited for causing problems within the SMZ included skidding through streams; improper management of logging slash; use of heavy equipment for harvesting and site preparation activities in such a way that damaged streambanks and beds; and broadcast burning through the SMZ that removed residual vegetation and made streambanks susceptible to erosion.

On the positive side, the timber sales received high marks for planning new road locations to leave an adequate SMZ between the road and stream. Twenty-five of the twenty-seven rated sales met or exceeded this BMP. On the one new road judged to be be a major departure from the BMP, damage was expected to be extensive and long-term.

Road drainage features and erosion control practices associated with road construction also exhibited a relatively high frequency of departures from best management practices. The eight practices that dealt with these topics were given a total of 184 ratings; of these, 65 (35%) represented departures, including 18 (10%) that were rated as major departures. The

practice of providing adequate drainage for closed roads was the only individual practice rated as a departure in more than 50% of the ratings (12 departures in 22 sales, consisting of 4 major and 8 minor). Installation of drainage features to route water through the streamside management zone (to filter out sediments before the drained water reaches a stream) had the highest percentage of ratings reflecting a major departure from drainage-related BMPs. Three of the 15 ratings in this category (20%) were rated as major departures.

A number of management practices were found to be consistently conducted in conformance with best management practices. These included road planning (including appropriate construction standards; avoidance of SMZS, areas with steep slopes or other erosion hazards; and minimizing the number of stream crossings); skidding practices (when conducted outside of the streamside management zone); restrictions on harvesting operations and road use during wet periods; properly installed stream crossings; appropriately sized and located landings; and the various site-preparation practices.

The distribution of timber sales audited did not meet the initial objective of focusing on high-hazard sites. Only one of the 38 sites combined a moderately steep slope (45% - 70%) with high hazard soils (see page one of the audit form in Appendix I for brief descriptions of the slope and soil sensitivity categories). The large majority of sites (27) had slopes under 45%, and only one site was characterized by significant areas of slopes greater than 70%. Fifteen of the sites had low-hazard soils, while 16 others had either moderate-hazard soils or a mix of low- and moderate-hazard soils. Only 7 sites had soils with a high or moderately high erosion potential; these soils derived from parent materials characterizing the Boulder batholith, certain volcanic deposits, or soft metamorphic rock.

The failure to meet the target for high-hazard soils stemmed from the difficulty of determining site-specific soil types from available maps. The absence of steep slopes in the audit sample apparently resulted from the audit criterion that required a perennial (preferred) or intermittent stream within 200 feet of the timber sale. As a result, many of the sales were in drainage bottoms, rather than on steep slopes.

Three other comments were made by participants in the audit process. Some felt the audits should have included only sites with new road construction, because roads have been identified as the major sediment sources from logging operations. Only 12 of the sales included more than a minor amount of new road construction.

Others commented that climatic conditions affecting the 1986 timber sales -- two years of low snowpack and below normal runoff, coupled with the very dry summer of 1987 -- may have affected the observations and ratings of the audit teams. The

audited timber sales have not been exposed to erosive forces typical of Montana's forested watersheds, so the management practices may have been considered more effective than they otherwise might have appeared.

Finally, some audit team members expressed a belief that reporting the audit findings based solely on the numerical ratings is not the best way to characterize on-the-ground practices. The west central team completed a narrative summary of most of its audited timber sales, and members indicated that these summaries are necessary to provide an understanding of the ratings given, the conditions faced by the timber operator, the reasons for any departures noted, and recommendations for future BMP application.

2. Questionnaire

Respondents to the questionnaire on "Watershed Problems and Solutions for Forest Management in Montana" (Appendix E) provided information on one hundred and forty-one recent timber harvest operations in Montana. Sixty of these sites were submitted for Part I of the questionnaire (watershed damage caused by forest practices) and 81 sites were submitted for Part II (representing model timber harvest operations).

a. Watershed Damage:

Persons citing examples of watershed damage caused by forest practices indicated a range of physical effects to streams and streamside zones. Sediment on the streambed, excessive disturbance of riparian zone vegetation and soils, and a breakdown of streambank structure were the major types of damage cited. The majority of respondents, however, indicated that they did not have enough information to determine if the observed effects were damaging fisheries or other beneficial uses. Five respondents indicated drainages where they believe watershed damage has been caused by the cumulative effects of multiple logging operations. The effects cited were increased water yield, sedimentation and resulting damage to the stream channel by peak flows.

While these responses help characterize site conditions, their validity in assessing the effects of forest practices has been called into question by some participants in the HJR 49 study. These participants note the difficulty of determining a cause-and-effect relationship between forest practices and observations of stream conditions. They also cite the lack of validation of the observations, the potential for inconsistency among various observers submitting the evaluations, and the potential for bias.

Other study participants believe questionnaire responses to Part I may have been limited in number by the reluctance of professionals to report on their own problem sites (to avoid

criticism) or on problem sites within other ownerships (to avoid jeopardizing relations with other forest landowners).

Given these difficulties with assessments of watershed effects, this aspect of the questionnaire may be of primary value in providing site-specific reports that can be followed up in a systematic manner in the future. Questionnaire responses, however, should probably not be considered to indicate the magnitude of watershed problems due to forestry in Montana.

Questionnaire respondents did provide specific information on those practices causing watershed damage, identifying 182 improperly applied management practices in the 60 sites (Table 3).

TABLE 3. IMPROPERLY APPLIED MANAGEMENT PRACTICES: Watershed Effects Questionnaire Returns

MANAGEMENT PRACTICE	# OF SITES AS A MAJOR SOURCE	TOTAL SITES AS CONTRIB. SOURCE
Inadeq. erosion control/road pioneering	3	14
Inadeq. erosion control/other road const.	3	9
Inadeq. road drainage facilities	4	20
Inadeq. maintenance of drainage	0	9
Poorly designed/installed stream xings	1	7
Road located too near stream	5	13
Road located on steep slope/high erosion haz.	3	10
Inadeq. revegetation of disturbed soils	3	8
Excessive logging disturbance in SMZ	6	17
Equip. operation during wet periods	2	8
Equip. operation in wet sites	4	11
Inadequate erosion control from skidding	7	20
Equip. operation in stream channel	7	11
Improper management of logging slash	6	17
Excessive soil disturbance in site prep.	0	6
Other (landing location; fireline erosion)	1	2
TOTAL PRACTICES REPORTED	55	182

There was a considerable degree of consistency in the practices rated as sources of problems by questionnaire respondents and those rated similarly by the field audit teams. Two of the four practices cited most often as bearing primary responsibility for damage were directly related to streamside management (excessive disturbance of the SMZ and equipment operation in stream channels). Improper management of slash was another often-cited problem related to streamside management, as respondents reported slash in the stream channel as the cause of damage. Road drainage problems were cited in 20 of the 60 sites

reported in questionnaire responses as contributing to watershed impacts.

Questionnaire respondents identified as problems two practices that scored very well during the on-site audits. While the 27 field audit ratings indicated only one major instance of a new logging road encroaching on the streamside zone, respondents to the questionnaire cited 13 examples of this practice as contributing to watershed damage. Respondents also cited inadequate erosion control from skidding practices as a major problem at 7 sites, and a contributing factor at 13 others. In contrast, during the field audits, skidding practices (outside of the streamside zone) were rated highly for minimizing soil disturbance and compaction.

b. Model Operations:

Through questionnaire returns, resource professionals provided 81 examples of recent timber sales that have dealt effectively with sensitive environmental conditions, such as streamside management zones, important fisheries habitat, and highly erosive soils. Examples of management practices employed under these conditions included:

* winter logging in wet sites to take advantage of frozen ground;

* line skidding, rather than using tractors, to yard timber from steep slopes;

* leaving buffer strips of vegetation along streams, coupled with the exclusion of heavy equipment from the streamside zone;

* using existing road systems as a means for reducing soil disturbance when re-entering stands harvested decades ago;

* dewatering of stream channels (through a short re-routing of the stream) when installing crossings;

* skyline yarding to prevent any soil disturbance of streambeds or banks; and

* development of new landings away from the streamside zone, despite an existing road system along a drainage bottom.

3. Other Information Sources

The Montana Department of Fish, Wildlife and Parks conducted a limited series of field assessments of timber sales during the summer of 1987 (DFWP 1988). Study objectives were to identify sites perceived as having been impacted by forest practices; to

evaluate the effects of forest practices on streambeds, streambanks, and sediment delivery at these sites; and to suggest practices that could prevent the observed problems. Through a survey mailed to departmental personnel, hydrologists, and other individuals, DFWP received reports of 67 perceived problem sites. The department conducted field assessments at 19 of these sites, using the stream reach inventory and channel stability rating developed by the Forest Service (Pfankuch 1978). This system assesses stream bottom stability, deposition of fine sediments, bank cutting, and other physical factors to derive a rating class ("excellent", "good", "fair", or "poor") for stream condition.

Of the 19 sites assessed, forest practices reduced the stream condition rating class at five sites. At four other sites, a reduction in rating class was attributed to a combination of land uses, including forestry, grazing, and mining. The forest practices cited for damaging stream condition included debris deposition, skidding and yarding in stream channels (4 cases), roads and associated fill slopes bordering streams (5), inadequate road drainage (4), and lack of a streamside equipment buffer during timber harvest (3). The report indicates that adherence to accepted best management practices would have prevented adverse impacts on stream condition.

In 1985, the Water Quality Bureau mailed a written survey to forest hydrologists, conservation district supervisors and other resource professionals to determine the nature and extent of nonpoint source water pollution problems in Montana. The survey was undertaken as part of a national effort coordinated by the Association of State and Interstate Water Pollution Control Administrators, and nationwide results were published in a summary document (ASIWPCA 1985).

Montana respondents identified about 355 miles of streams suffering severe or moderate impairment of beneficial uses because of forest management. For all land uses, 7,780 stream miles exhibited use impairment. Montana's "Nonpoint Source Assessment", a report submitted by the Water Quality Bureau to the U.S. Environmental Protection Agency in August 1987 (MWQB 1988a), used the ASIWPCA data to derive the following relative impacts of nonpoint sources: agriculture 46%; forest practices 3%; mining 7%; land disposal 12%; hydromodification 26%, and other 3%.

Although the ASIWPCA effort represented a comprehensive survey on nonpoint source water pollution in Montana, a number of cautions have been raised about the accuracy of the data. First, the critiques that apply to EQC's questionnaire are also valid for this survey (see above). Second, the written returns were extremely variable in quality and in the amount of explanation provided. Third, the low number of streams reported as having watershed damage from forest practices was in sharp contrast to the returns for survey efforts done seven years earlier under the

Section 208 state nonpoint source water quality management planning program. For example, in 1978 the Forest Service reported about 250 forestry-related problems on national forest lands, and 170 problem sites were reported on state and private lands (see next paragraph). Forest Service staff submitted fewer than 10 stream segments for the 1985 ASIWPCA effort, and a total of 38 stream segments were submitted statewide. Finally, some of the survey respondents identified very long stream segments (20 miles or more) as suffering impacts from forest practices through assessments based entirely on professional judgment. In sum, the data provided through the ASIWPCA effort may provide a perspective on the relative impacts of forest practices on water quality, but should not be treated as a definitive source on the magnitude of the problem.

The Section 208 surveys conducted in 1978 represent the most intensive efforts to characterize the impacts of forest practices on water quality. In a statewide assessment of silvicultural effects, 170 "known, suspected, or anticipated" water quality problems were identified on state and private lands (Rasmussen and Culwell 1978). For each problem site, the location, affected stream, type of impact, cause, and suggested mitigation measures are provided. The report notes, however, "In most cases, reported problems were difficult to document . . . due to the nature of non-point pollution and the lack of adequate stream monitoring systems" (p. 40). In the decade since publication, only the Missoula Conservation District has conducted any organized follow-up of these reported problem sites.

In 1978 the Forest Service reported that roading, timber harvesting, and logging were responsible for about 250 "pollution significant" problems on national forest lands (Wheeler 1978). That report rated 15% of the problems as "high severity", but noted that the great majority could be corrected. The problem sites were referred to the national forest staffs for action, but the agency has done no comprehensive follow-up evaluation of these sites.

4. Cumulative Watershed Effects

There is little direct evidence on the cumulative effects of forest practices on Montana watersheds. This finding is related both to the difficulties of conducting long-term studies and the fact that Montana has not experienced any catastrophic events, such as the sedimentation that occurred as a result of forest practices on the South Fork of the Salmon River in Idaho in the mid-1960s (Wann 1988). State water quality officials, however, have expressed concern over the potential for cumulative impacts, particularly in relation to the accelerated timber harvests in steeper headwater areas (MWQB 1986). Professionals responding to the HJR 49 questionnaire indicated several areas in Montana where cumulative effects appeared to be affecting watershed conditions, and land managers are increasingly utilizing watershed models to

indicate when management thresholds for cumulative effects might be exceeded.

Through meetings of the Watershed Effects Working Group and the Environmental Quality Council, the HJR 49 study provided a forum for discussion of cumulative watershed effects from forest practices. The study, however, did not develop additional technical findings on the relationship between forest management and cumulative watershed effects in Montana. Instead, the study tracked the ongoing efforts of the Montana Cumulative Watershed Effects Cooperative (MCWEC) to devise a procedure for addressing potential cumulative effects (described in section C.2. of this chapter). This approach was taken in recognition of the considerable overlap between HJR 49 study participants and the participants in the MCWEC. Thus, an attempt to resolve cumulative effects issues through the Watershed Effects Working Group would have been duplicative.

B. BEST MANAGEMENT PRACTICES

Best management practices (BMPs) have been defined as "a practice or combination of practices that is determined by a state after problem assessment, examination of alternative practices, and appropriate public participation, to be the most effective, practical (including technological, economic and institutional considerations) means of preventing or reducing the amount of pollution generated by non-point sources to a level compatible with water quality goals" (40 CFR, 130.2(q)). BMPs include planning components, as well as on-the-ground management techniques. Proper implementation of BMPs is largely dependent on a sequential process, beginning with the establishment of sale objectives, and continuing through sale layout; road construction, reconstruction and maintenance; harvest; and the preparation of the site for timber regeneration.

The Best Management Practices Technical Committee began its work with the goal of developing management practices that would conserve Montana watersheds and retain the economic viability of timber harvest operations. The committee structured its review along the format of the BMPs developed through the Montana Cumulative Watershed Effects Cooperative in 1987. Additional ideas for BMPs came from other state and agency programs, Section 208 reports, and the field experiences of technical committee members.

The committee's most recent draft set of best management practices (Appendix H) was prepared in mid-October 1988. These BMPs are the product of four meetings and 18 hours of group discussion on suggested language for more than 100 specific BMPs. Discussions often pivoted around the appropriate balance between the need for flexibility (so operators could react to site conditions) and the need for specificity (to provide enough guidance to prevent water quality impacts).

The BMPs are the final study product of HJR 49 and generally represent the consensus of the Best Management Practices Technical Committee. However, comments received from the Department of State Lands and the Water Quality Bureau indicate that final language on certain best management practices, including streamside zones, still needs to be resolved.

Roads are the major sediment source from forest management, and the BMPs address possible sediment erosion from roads in five categories (planning and location, design, drainage from road surface, construction, maintenance). Committee members emphasized that proper BMP application becomes crucial where soils are sensitive. This influence of site conditions was recently noted (Idaho 1988a): "Roads on gentle to moderate slopes and stable topography have a low potential for contributing sediment when properly constructed and maintained. However, roads located adjacent to streams, on steep slopes, and/or unstable topography have a high potential to produce sediment for a long period of time if not properly planned, constructed, and maintained."

The committee developed a separate subsection on streamside management zones, so practices recommended for these sensitive areas could be found in one location. Members agreed upon a definition of the streamside management zone (SMZ) as "not a zone of exclusion, but a zone of closely managed activity." The definition notes that the SMZ "acts as an effective filter and absorptive zone for sediment; maintains shade; protects aquatic and terrestrial riparian habitats; protects channel and streambanks; and promotes floodplain stability." SMZs apply to perennial streams and to intermittent streams with a defined bed and bank. SMZ width was set at a minimum of 25 feet, to be expanded where wetlands, steep slopes, or erosive soils are adjacent to the stream corridor. Operators are advised to minimize operation of heavy equipment in the SMZ, keep slash out of streams, and to consider a variety of practices to retain the integrity of riparian vegetation and soils.

The committee also developed a separate section on the 310 permit, which is administered by conservation districts and required for crossings of perennial streams. The section is intended to respond to the experiences of committee members, who indicated that many private landowners and timber operators are unaware of the permit requirement.

The committee also developed a section on BMPs for winter logging. Winter logging on frozen ground can be an good method to avoid potential watershed damage when harvesting in sites with high water tables, wet areas or sensitive riparian conditions. Two recurrent problems with winter logging were noted in committee discussions. These are the operator's failure to mark stream channels prior to snow cover (and the resulting potential of the operation to damage streambeds and banks when operating

unknowingly in these areas) and failure to install adequate erosion control features prior to spring runoff.

C. FRAMEWORK PROMOTING BMPS; ADMINISTRATIVE AND LEGAL CONSIDERATIONS

House Joint Resolution 49 calls for an evaluation of "the existing administrative framework, including regulatory and voluntary efforts, promoting the use of best management practices in Montana and other states." The following section reviews the laws and programs that deal with the relationships between forest management and water quality in Montana and neighboring states.

1. Water Quality Bureau

a. Legal Considerations:

The Water Quality Bureau (WQB) of the Department of Health and Environmental Sciences administers the Montana Water Quality Act, which expresses state policies (1) to conserve and enhance water quality and (2) to provide a comprehensive program for the prevention, abatement, and control of water pollution (75-5-101, MCA). The act contains a broad prohibition statement that declares it "unlawful to cause pollution . . . of any state waters or to place or cause to be placed any wastes in a location where they are likely to cause pollution" (75-5-605(1)(a), MCA).

Rules adopted to implement the Water Quality Act allow the department to order persons to eliminate or reduce pollution resulting from logging practices and other nonpoint sources (16.20.633(8), ARM). Also, plans and specifications for the construction and operation of logging roads must be submitted to the department for approval by persons undertaking forest practices on public water supply watersheds (16.20.633(11), ARM).

b. Stream Classifications and Beneficial Use:

The Montana Water Quality Act provides for the classification of state waters according to their beneficial uses. Most forest streams in Montana have been classified B-1, and as such are deemed suitable for a range of uses, including drinking water after conventional treatment; bathing and other contact recreation; growth and propagation of salmonid fishes and associated aquatic life; and agricultural and industrial uses. Some forest streams are B-2, a slightly lower water quality classification which provides for the same uses except that propagation of salmonid fishes is "marginal". Forest streams that provide high-quality public water supplies have an A classification, indicating the water can be used for drinking with only to simple disinfection, in addition to the other uses specified for class B waters.

Under the water quality act, all beneficial uses specified for a given stream classification must be protected. Salmonid propagation (i.e., the spawning and rearing of trout) is the use most sensitive to potential adverse impacts from sediment and

other disturbances of the stream ecosystem; as a result, consideration of water quality in forested watersheds generally becomes a question of fisheries habitat protection (Idaho 1988a). Phrased in terms of legal compliance, if a forest management operation damages the ability of a stream to support a healthy, naturally reproducing trout population, that operation would be in violation of the Water Quality Act (see section A.3. in Chapter VI. for further discussion of this issue).

c. Water Quality Standards:

The Water Quality Act also specifies certain measurable parameters that pertain to each stream classification. The measurable parameters (water quality standards) most likely to be impacted by forest practices are turbidity, temperature, and dissolved oxygen (see Section II). Turbidity is a measure of the decrease in the penetration of light through water, and thus indirectly a measure of the amount of sediment being carried by the water. Montana's turbidity standard allows an increase of 10 nephelometric turbidity units above naturally occurring levels in class B-2 streams, 5 units in B-1 streams and no increase in class A streams. A rise in water temperature cannot exceed 1°F above naturally occurring conditions for any of these stream classes. Dissolved oxygen concentrations in an A or B-1 stream must not be reduced below 7 milligrams per liter (mg/l), while B-2 streams can experience concentrations of 6 mg/l during the summer.

The Water Quality Act also expresses a "nondegradation policy", which generally requires that state waters cleaner than water quality standards must be maintained at that cleaner level. Thus, for example, if a B-1 stream had dissolved an oxygen concentration of 10 mg/l, it would be a violation of nondegradation to cause that oxygen concentration to fall to 8 mg/l, even though this resulting concentration still exceeds the water quality standard of 7 mg/l. The Board of Health and Environmental Sciences may waive the nondegradation requirement if "necessary economic or social development" justifies a change in the quality of the receiving water. However, water quality standards must still be met and beneficial uses must be protected.

The Water Quality Act provides special consideration for "nonpoint sources" of water pollution -- i.e., forestry, agriculture, mining and other land-uses that generate pollutants from activities over a large area of land. Under 75-5-306, MCA, conditions resulting from nonpoint sources "where all reasonable land, soil, and water conservation practices have been applied" are defined as natural.

This definition can be very important to the compliance status of forest management operations. Take, for example, a timber operation that uses best management practices and yet generates enough sediment to elevate turbidity in a B-1 stream by 15 units at some times. The operator's activity would not be a

violation of the turbidity standard because, given the use of best management practices, the sediment additions and resulting rise in turbidity are considered naturally occurring. The operation thus has not exceeded the B-1 water quality standard of a 5-unit increase "above naturally occurring turbidity."

As stated by the Water Quality Bureau in its comments on the HJR 49 draft report:

> " The implications of [75-5-306, MCA, and rules adopted under it] for forest management operations and other potential nonpoint sources of pollution are as follows:
>
> 1. Changes in water quality that result from an operation that does not employ best management practices ("reasonable land, soil and water conservation practices") would be considered degradation.
>
> 2. An operation employing best management activities may, without penalty, cause a decline in water quality down to the level required to protect present and reasonably anticipated beneficial uses.
>
> 3. In no case may an operation cause a water quality parameter to exceed its numerical standard as given in the Montana surface water quality standards or to otherwise impair a beneficial use.
>
> If the application of best management practices still result or is expected to result in a violation of water quality standards, then one of the following must occur:
>
> 1. The operation is restricted or postponed;
>
> 2. Better, more effective BMPs are applied; or
>
> 3. The water quality standard is adjusted downward, providing site-specific studies show that beneficial uses would still be protected. Downward adjustment of stream classifications can only be done if it is shown that they were improperly classified originally."

d. Administrative Approach:

The State of Montana has adopted a nonregulatory approach to controlling nonpoint source pollution. As a result, compliance with best management practices is generally voluntary for persons engaged in forestry, agriculture and other nonpoint activities (with the exception of practices regulated by streambed preservation laws and other specific regulations). This nonregulatory approach is consistent with the options provided to states in the federal Clean Water Act.

The Water Quality Bureau currently assigns one-half of an environmental specialist position to the control of nonpoint pollution from forest practices. The duties of this staff person

include working with the managers of forest lands to minimize or mitigate water quality impacts, reviewing national forest management plans, and participating in various technical review efforts. The bureau does not have a systematic program for monitoring water quality in relation to forest practices, but does conduct site-specific monitoring projects where water quality impacts are of concern and when financial resources allow. Priorities for WQB efforts are based on the potential impact on water quality, with the highest priority given to public water supplies. Site inspections related to potential violations of water quality laws are generally triggered by public complaints. Since 1975 the Water Quality Bureau has responded to about 30 instances where forest practices have been suspected of violating water quality standards; three of these inspections have resulted in formal enforcement actions, while a number of others were resolved through administrative action requiring site rehabilitation without formal enforcement proceedings.

Over the past 15 years, the Water Quality Bureau has helped direct two major water quality management planning efforts for nonpoint sources. The initial effort took place during the late 1970s in conformance with Section 208 of the federal Clean Water Act. The Water Quality Bureau, along with four regional nonpoint source planning organizations established in Montana, conducted a range of studies to generate information on baseline water quality conditions, nonpoint source impacts, and best management practices. Water quality management plans for forestry (Rasmussen and Culwell 1978) and other nonpoint sources were subsequently developed for public comment. The statewide water quality management plan recommended that a nonregulatory approach based on education and technical assistance be utilized for forest practices, with local conservation districts serving as the lead agencies. If that approach proved not to be successful, the plan called for a regulatory approach by the Water Quality Bureau: "If substantial progress from the nonregulatory program is not demonstrated in terms of improved logging and timber harvesting practices adjacent to streams before the 1984 Legislature, the second option, a state forest practices act, should be introduced and passed by the Legislature" (MWQB 1979).

Because of the absence of federal funds for implementation, however, the recommended elements of the Section 208 management plan for forest practices and other nonpoint sources have remained largely dormant. There has been no formal judgment by the Water Quality Bureau or other entities on whether the voluntary approach has been successful in controlling nonpoint source pollution from forest practices.

Congressional enactment of Section 319 of the Clean Water Act in 1987 gave renewed emphasis to state programs to control nonpoint pollution. To comply with Section 319 provisions, WQB provided the U.S. Environmental Protection Agency with a state nonpoint source assessment report and a management plan in August

1988 (MWQB 1988a and b). The assessment outlines available information on nonpoint source water quality problems in Montana, while the management plan details existing state programs, best management practices, and initiatives to increase the effectiveness and improve coordination of nonpoint control efforts.

The Water Quality Bureau has proposed three program goals in its Section 319 plan to reduce sedimentation from forest practices. These goals are to cooperatively develop a new statewide package of best management practices; to conduct a BMP information and education program for private landowners and land users; and to demonstrate at least two improvement projects on silviculturally impaired streams.

Although the first program goal is ongoing (through efforts of the Montana Cumulative Effects Watershed Cooperative and through the HJR 49 study), the other goals await funding. To date, Congress has not appropriated funds to the states to implement the Section 319 programs--notwithstanding a nationwide four-year $400 million authorization that Congress enacted in 1987 in conjunction with Section 319. The BMP information and education program may receive funding through a two-year grant proposal submitted by the Department of State Lands under the Renewable Resources Development Program. Funding for grants under this competitive program must be approved by the 1989 Montana Legislature. The DNRC Conservation Districts Division has also requested a grant under this program to conduct nonpoint source control demonstration projects, including possibly a forestry rehabilitation project.

Under both the 208 and 319 programs, Montana has designated its 59 soil conservation districts as the nonpoint source water quality management agencies for non-federal lands. The Water Quality Bureau provides technical assistance to the conservation districts on request as resources allow.

2. Department of State Lands

The Department of State Lands, through its Division of Forestry, manages timber production on state lands and administers two primary programs affecting forestry operations on private lands. The department also coordinates the Montana Cumulative Watershed Effects Cooperative, a voluntary effort to improve watershed management.

a. Management of State Forest Land:

The Department of State Lands manages timber on 681,000 acres of state forest land and had a 1987 harvest volume of 56 million board feet. DSL employs a hydrologist and a soil scientist to review potential watershed concerns with each sale.

The DSL timber sale program is subject to review under the Montana Environmental Policy Act (MEPA), which requires state

agencies to describe and evaluate potential environmental effects of their resource management decisions. Potential water quality effects and recommended mitigation measures are discussed in the preliminary environmental reviews prepared by DSL to meet MEPA requirements for each sale.

b. Fire Hazard Reduction Program:

The fire hazard reduction program is the state's means of ensuring that logging slash remaining following timber harvest will not constitute a fire hazard. Any person engaging in commercial timber harvest or timber stand improvement must enter into a hazard reduction agreement with DSL and must post a bond with the department as a guarantee that appropriate actions will be taken to reduce slash. The law also requires timber purchasers to confirm the existence of the hazard reduction agreement before buying logs from an operator. Department of State Lands foresters inspect each completed timber sale for slash disposal prior to releasing the bond. A consequence of the hazard reduction program is that the DSL maintains records on the location, date, ownership, and timber volume harvested for each private timber sale in Montana.

c. Private Forestry Assistance Program:

The DSL Private Forestry Assistance Program offers free assistance to private landowners interested in technical advice on the growing, marketing and harvesting of timber. Upon request DSL foresters will arrange to meet with the landowner and assist in designing a sale to optimize income and the health of the residual timber stand. Although water quality considerations have not been a main focus of the program, a recent study (Jackson 1988) concluded that landowners using the Private Forestry Assistance Program are much more likely to employ best management practices than landowners not receiving assistance. Due to limitations in funding and staff, DSL has had difficulty keeping up with the demand for assistance and has not aggressively promoted the program. An estimated 10% of the 900 nonindustrial timber sales in 1988 utilized private forestry assistance.

d. Montana Cumulative Watershed Effects Cooperative:

The Montana Cumulative Watershed Effects Cooperative (MCWEC) was formed in 1984 at the encouragement of State Forester Gary Brown to promote cooperative timber sale planning to mitigate cumulative watershed effects. Members include Plum Creek Timber Company, Champion International, U.S. Forest Service, Bureau of Land Management, Department of State Lands (Division of Forestry), Department of Health and Environmental Sciences (Water Quality Bureau), and the Department of Natural Resources and Conservation (Conservation Districts Division). The Montana Logging Association, Montana Association of Conservation Districts, and Department of Fish, Wildlife and Parks became associate members in 1988. The cooperative covers mixed ownership drainages in the vicinity of the Lolo, Flathead and Kootenai national forests, thus encompassing the majority of

drainages in Montana with intermingled state, federal and industrial private lands.

The initial MCWEC effort was development of a Memorandum of Understanding through which members endorsed and agreed to apply a set of best management practices for forestry in Montana. That memorandum was signed in April 1987.

During the past year, MCWEC has focused on the issue of cumulative effects, attempting to develop a methodology for determining when cumulative effects might occur and a process specifying how to resolve potential problems. Cooperators agreed that the process "may identify the need to modify management practices in order to meet water quality objectives." A technical subcommittee was appointed to work on this effort.

In July 1988, the subcommittee issued its report, titled "A Process to Address Watershed Effects in Mixed Ownership Drainages" (Appendix J). The three-phase process agreed upon by the MCWEC members includes a mechanism to identify existing or imminent cumulative watershed effects; a mechanism to verify cumulative watershed effects; and a problem resolution process. Phase I, problem identification, relies on the "WATBAL" watershed model developed by the Forest Service to predict water and sediment yield increases based on information about existing and proposed timber harvest, roads, and fire. If, based on the model, a cooperator raises concerns over potential adverse cumulative effects within a drainage, that cooperator is responsible for verifying the problem and convincing others that the concerns are legitimate. The verification process may rely on water quality and quantity data, a review of the management history, observations of stream conditions or fisheries, or other factors. Phase 3, problem resolution, involves development of a cooperative plan to protect water quality. That plan, which must be agreed upon by affected cooperators, may involve application of mitigation measures, shifting the locations of activities, or deferral of activities in a drainage. The stated long-range plans of the MCWEC are to continue reviewing and refining watershed models, to make better use of computer and data facilities, and to enhance the process through improved planning and communication.

3. Department of Natural Resources and Conservation

The Conservation Districts Division (CDD) of the Department of Natural Resources and Conservation is responsible for assisting and supervising Montana's 59 local conservation districts. Because of funding limitations, CDD has been able to provide little forestry-related assistance to conservation districts in terms of money, technical assistance, or educational programs. During the 1988, CDD submitted a grant request to the Reclamation and Development Grants Program requesting $262,000 for conservation districts to implement a nonpoint source pollution control program, including forest practices. This

grant request, which will be presented to the 1989 Montana Legislature, focuses on watershed demonstration projects that could be carried out by the districts in their role as the designated nonpoint source management agencies for Montana.

4. Department of Fish, Wildlife and Parks

The Department of Fish, Wildlife and Parks (DFWP) is occasionally involved with forest management issues in relation to the conservation of fisheries habitat. Although the department conducted a 1987 survey of forest management practices (see section A.3. in Chapter V), it does not carry out a structured program of overseeing timber sales. The department does conduct special research projects and periodic monitoring of important fish populations; some of this research has been directed at assessing the effects of sediment on fisheries (e.g., Weaver and Fraley 1988).

DFWP is currently participating in the Flathead Basin Forest Practices, Water Quality, and Fisheries Cooperative Program, a multi-phase research effort designed to determine how forest practices are affecting water quality and fisheries. Other participants in the study include the Flathead Basin Commission, Department of State Lands, Water Quality Bureau, Forest Service, University of Montana and Plum Creek Timber. The department is also an associate member of the Montana Cumulative Watershed Effects Cooperative, and DFWP fisheries staff participate in an informal working group with Forest Service on land management issues. Although water quality laws require protection of beneficial uses, there is no formal relationship between DFWP and the Water Quality Bureau to assess the impacts of nonpoint pollution on trout populations or to develop criteria for making this assessment. Stream crossing projects initiated by federal, state or local agencies are subject to approval under the "124 permit" process administered by the Department of Fish, Wildlife and Parks.

5. Conservation Districts

Montana's 59 local soil and water conservation districts are the designated management agencies for nonpoint source water pollution control programs in Montana. The districts played an active role in the Section 208 water quality planning efforts of the late 1970s, but in recent years have not had sufficient resources to implement nonpoint programs for forestry (beyond the streambed permit process described below). The Montana Association of Conservation Districts endorsed the forestry best management practices developed by the Montana Cumulative Watershed Effects Cooperative at the association's annual state meeting in November 1987. The resolution of endorsement "recognize[d] these practices as the minimum standards for forestry practices in Montana."

In the event funding is secured to implement a nonpoint program under Clean Water Act Section 319, conservation districts are expected to provide guidance and assistance in BMP implementation, sponsor watershed demonstration projects, and participate in water quality education programs (WQB 1988b).

a. Stream Crossings:

Under the Natural Streambed and Land Preservation Act of 1975 (the "310 law"), any activity that would result in physical alteration or modification of a perennial stream, its bed or immediate banks must be approved in advance by the supervisors of the local conservation district. Permanent or temporary stream crossing structures, fords, riprapping or other bank stabilization measures, and culvert installations on perennial streams are some of the forestry-related projects subject to 310 permits. Skidding logs through a stream (not a recommended practice, but one that was observed by the audit) would also require a 310 permit.

Before beginning a streambank alteration, the operator or landowner must notify the conservation district of project location, description, and plans. The evaluation generally includes on-site review by a team of conservation district supervisors and staff and a representative of the Department of Fish, Wildlife and Parks. The landowner may be required to modify the project to reduce potential impacts, and in cases where impacts cannot be adequately mitigated, a project may be denied. The entire permitting process takes up to 60 days.

b. Conservation District Ordinances:

Under state law (76-15-701, MCA), conservation districts may adopt land-use regulations to conserve soil and water resources and to control erosion. In 1977 the Lewis and Clark County Conservation District adopted a sediment control ordinance to regulate forest practices and other land uses. The ordinance references BMPs for forestry and requires persons intending to conduct forest practices to submit and receive approval of a plan to mitigate potential soil erosion problems. Although the district does consider and approve complying logging plans during its meetings, a lack of resources has precluded any active program of conducting site visits (except for complaint investigations), overseeing logging operations, or enforcing the mitigation measures. There is currently no data reflecting the degree of compliance with the Lewis and Clark County ordinance.

6. Federal Agencies

As outlined through separate memoranda of agreement with the Water Quality Bureau, both the U.S. Forest Service and the Bureau of Land Management have been designated as the nonpoint source management agencies for their respective federal lands in Montana. In this role, the federal agencies are responsible for ensuring that best management practices are used to minimize nonpoint source water pollution from activities on their lands.

Federal statutes provide strong direction for the consideration and mitigation of potential water quality impacts from forest management activities under Forest Service and BLM jurisdiction. Water quality issues are addressed in long-range planning, project planning, environmental assessment, project implementation and monitoring. Each agency retains staff hydrologists in various geographic jurisdictions (national forests for USFS and districts for BLM) to provide technical expertise on water quality issues. Under provisions of the federal Clean Water Act, federal agencies must comply with state water quality standards.

Both the Forest Service and the BLM undertake project-specific efforts to monitor water quality and the implementation of management practices. The Forest Service also has an active program of "validation monitoring" -- i.e., an effort to assess the accuracy of and refine models that predict water quality and sediment impacts from land management activities. Despite a 1984 Forest Service report critical of that agency's failure to adequately integrate watershed concerns in its land management program (USFS 1984), the watershed budget for Region 1 (Montana and northern Idaho) remained considerably below levels called for in forest plans between 1984 and 1988. The regional watershed budget allocation of $4.3 million for fiscal year 1989, however, represents a more than 40% increase over the annual average watershed funding provided in the previous five years. The Forest Service's Northern Region (Montana and northern Idaho) is currently reviewing the results of 1988 timber sale audits in Montana and Idaho that indicated problems with BMP compliance on national forest lands, and intends to develop recommendations to respond to the findings.

7. Private Industry

The timber industry has been active in several recent efforts to promote the use of best management practices for forestry in Montana. Champion International and Plum Creek Timber are members of the Montana Cumulative Watershed Effects Cooperative, and have signed a memorandum of understanding to comply with the BMPs developed through that forum. Both companies also conduct internal audits of BMP application by their logging contractors. Plum Creek Timber is a participant in the Flathead Basin Forest Practices, Water Quality/Fisheries Cooperative Program, a new three-year effort coordinated by the Flathead Basin Commission to study and address the impacts of timber harvesting on water quality and fisheries. Finally, in early 1988 the Montana Wood Products Association, the Montana Logging Association, and the Montana East Side Forest Practices Committee (representing lumber mills east of the Continental Divide) adopted a resolution agreeing (1) to endorse the MCWEC best management practices and to incorporate them in their harvest operations, (2) to encourage log suppliers to utilize BMPs, and (3) to incorporate into log purchase agreements a provision calling for contract termination upon notification by

an enforcement official that a log supplier has violated a state law pertaining to timber harvesting.

8. Confederated Salish and Kootenai Tribes

The Confederation Salish and Kootenai Tribes have adopted a forest management plan for the Flathead Reservation which includes watershed protection guidelines. Operators are required to adhere to best management practices specified within tribal timber sale contracts and the Tribal Aquatic Lands Conservation Ordinance (87A). The guidelines also establish "limited management areas" that include streamside zones. Non-tribal lands located within the Reservation boundary are required to adhere to guidelines established by the Tribes.

9. Cooperative Extension Service

The Montana Cooperative Extension Service (CES) conducts educational and information programs related to natural resource management. CES employs a forestry specialist housed at the University of Montana and, until funds ran out in late 1988, published the Extension Forestry Digest for distribution to 400 forest landowners across the state. The publication has recently contained a number of articles related to the use of best management practices for forestry operations. The CES forestry specialist works with state, federal, local and private organizations to develop workshops, training sessions, and educational materials and programs on various aspects of forest management.

10. Forest Practices Water Quality Programs in Other Western States

Oregon, Idaho, Washington and California each have forest practice acts providing for mandatory compliance with best management practices by private forest landowners and operators. These acts contain the range of elements characteristic of forest practice acts (Henly 1988), including resource protection goals, state agency rulemaking authority, forest practice advisory boards, pre-sale notification requirements, and inspection and enforcement provisions.

The effectiveness of the forest practices acts depends on nonregulatory programs as well as enforcement, and each of the states sponsors a number of educational and technical assistance programs (Henly and Ellefson 1986). Strong enforcement procedures are typically "used only as a last resort" after compliance is sought through efforts to resolve violations on the ground by working cooperatively with timber operators and landowners (Henly 1988).

Forest practice acts have been successful in achieving water quality, fish, wildlife and reforestation improvements, but these benefits are difficult to quantify (Henley 1988). Costs have

been quantified (Henly, Ellefson, and Moulton 1988), with 1984 state expenditures in implementing forest practice acts of $1.6 million in Oregon, $2.3 million in Washington, and $4.6 million in California. More recent figures for Idaho (1988) total about $532,000 for a 13-person program in the Idaho Department of Lands.

Costs to timber operators for compliance with forest practice acts in 1984 were estimated to be a little over $2 per thousand board feet of lumber in Idaho, $8 in Washington, $12 in Oregon, and $25 in California (Henly, Ellefson, and Moulton 1988). These cost estimates are considered imprecise, however, due to the difficulty in separating compliance costs from the expense of practices that would be conducted even in the absence of mandatory requirements. The cost estimates also do not account for the financial benefits to the landowner that result from improved management practices.

There are several program elements that distinguish the forest practices programs in the Pacific Northwest region. California has one of the strictest forest practice acts in the United States (California 1986). The act requires a timber harvesting plan to be prepared by a registered professional forester before any commercial timber harvesting can be conducted. (To qualify as a registered professional forester, a person must have seven years of experience/education and pass a comprehensive written examination.) The timber harvesting plan describes how the logging operation will be conducted, including harvesting practices, road construction, erosion control and stream protection measures, and erosion hazard ratings. The plan is subject to review by an interagency team and to approval by the Department of Forestry. California also requires timber operators to be licensed, but there is presently no testing or educational requirement associated with this licensing.

Washington recently went through an extensive negotiation process among state agencies, the timber industry and environmental groups that resulted in adoption of a Timber/Fish/Wildlife agreement. The agreement improved protection for nontimber resources and developed a cooperative process to address issues not readily subject to regulation. A main component of the Washington program is termed "adaptive management" -- the process of updating and refining management and regulation in response to better understanding of the dynamics of forest practice activities (NRRC 1987). The adaptive management component is based on a series of research and monitoring projects, annual reviews of program implementation, and a willingness to address the priority issues by all participants in the agreement.

The Oregon forest practice rules also underwent some major changes in 1987, with increased protection established for riparian zones. Negotiations in Oregon also led to industry-

environmentalist agreements to resolve conflicts between forest practice regulation and local land-use ordinances.

The Idaho forest practices program is discussed in section C.3. of Chapter VI.

VI. DISCUSSION

A. WATERSHED EFFECTS

1. Watershed Effects, Water Quality and BMP Evaluation

House Joint Resolution 49 called in part for a study of "how current forest practices are affecting watersheds in Montana". Although water quality is a key watershed value and a focal point of public concern over forest practices, it became apparent from the initial meetings of EQC and the HJR 49 technical committees that there is a shortage of direct measurements on the impacts of forest practices on water quality in Montana.

In large part this relates to the difficulties of designing and carrying out a study that can separate effects of forest practices from natural occurrences. Forest water quality is determined by complex interactions among precipitation, soils, topography, geology, vegetation and land use, and thus undergoes considerable natural variation within a year and between years. Water quality impacts may be separated both in time and space from their causes, and may take different forms (e.g., movement of sediment in the water column (suspended sediment) versus movement of sediment along the stream bottom (bedload). A large number of samples must be collected to accurately characterize water quality conditions, and in most watersheds there is no baseline data to allow comparisons between pre- and post-logging water quality. Also, water quality monitoring can be very expensive, with a single sediment monitoring station costing up to $30,000 per year (NCASI 1988).

Given these difficulties, the lack of forestry-related water quality data in Montana is neither surprising nor atypical. In Idaho, which has had a forest practices act since 1974, there is virtually no data to indicate the effects of private forestry operations on water quality (Idaho 1988a). (Efforts to gather such data have recently been initiated).

As a substitute for direct measurements of water quality, the HJR 49 audits inventoried management practices and assessed their effectiveness in preventing the erosion of sediments from timber sales into adjacent drainages. Similar evaluations have been used in at least eight other states (NCASI 1988), and monitoring the application and effectiveness of BMPs has also been recognized by EPA as one key element of a state's nonpoint source control program (EPA 1987).

The approach of monitoring and evaluating BMPs to assess watershed effects relies on two observations that are widely supported in the literature: (1) the addition of sediment to forest streams can impair the uses that these waters sustain (e.g., fisheries and drinking water); and (2) appropriately applied BMPs generally are effective in reducing sediment

delivery. The synthesis of these two observations is that BMP evaluations are a reasonable method to indicate the potential for watershed damage from forest practices, and BMP evaluations are an appropriate surrogate for direct (but expensive and long-term) water quality measurements.

2. Timber Sale Audit Implications

The 38 field audits undertaken through HJR 49 found that 82% of the practices met the specifications of best management practices. However, a slight majority of the timber sales (20 of 38) had at least one major departure from BMPs, and these sales averaged 2.3 major departures. In the remainder of timber sales, only minor departures from BMPs were observed.

Inadequate protection of the streamside management zone was the single greatest source of watershed impacts. In more than one-third of the timber sales, activity in the zone was judged to be a departure from BMPs, and 18% of the sales evidenced major impacts on water resources from improperly applied streamside practices. Streamside zones have many properties considered crucial to protecting stream integrity, and they play an extremely important role in water quality and quantity, stream stability and fisheries habitat (Hansen 1988). Changes in streamside habitat conditions due to forest practices can include alteration of stream channel and bank structure, removal of streamside vegetation, sedimentation of fish habitat, blockage of fish passage, changes in the stream temperature and nutrient regimes, and effects on aquatic productivity (Riparian Habitat Technical Committee 1985).

Road drainage practices also demonstrated a high frequency of misapplication; more than one-third of these practices were rated as departures, resulting in major impacts to water resources in 10% of the effectiveness ratings.

Given that roads are the largest sediment source from forest management and that streamside zones are the most sensitive sites for water quality and fisheries considerations, the level of departures from recommended management practices in these areas may have important implications for Montana's forest watersheds. If the timber sale audit findings are representative, there is an apparent need to improve forest practices on industrial private, nonindustrial private and federal lands.

3. Assessing Effects on Beneficial Uses

Establishing a connection between these findings and actual effects on beneficial uses of Montana waters is extremely difficult. There are large annual variations in sediment loads due to weather-soil-streamflow interactions; natural fluctuations occur in the populations of trout and aquatic insects; the complexities in sediment movement and storage in streams are not well understood; thresholds for impacts on have not been

determined; and in some locations there are difficulties in separating out the contributions of other land uses, such as grazing. In recognition of these factors, the audit teams did not attempt to evaluate the degree to which sedimentation caused by forest practices might be affecting beneficial uses in the receiving streams.

The difficulty of determining impairment of beneficial uses has prompted water resource specialists to begin to develop measurable physical parameters that can be used to indicate when and to what extent forest watershed uses are likely to be affected by sediment. These parameters are intended to serve both as indicators when thresholds are being approached and as enforcement tools that will allow watershed managers to require practices be altered to prevent resource damage.

The result of this work has been a shift in focus from water quality to stream quality. Stream quality parameters include streambed composition, stream channel and bank structure, the amount of large woody debris in and along the channel, and fish habitat condition. Stream quality measurements are seen as more directly related to the protection of beneficial water uses from potential forestry impacts than are standard water quality measurements (NCASI 1988).

Techniques for measuring stream quality characteristics are still evolving. A comprehensive review of the relationships between various sediment measurements and salmonid survival and reproduction indicated the strengths and weaknesses of a variety of available techniques; the review also outlined additional research necessary to improve the criteria used to determine whether fine sediments are impacting salmonids (Chapman and McLeod 1987). The authors noted that "In view of uncertainty and environmental variability, professional judgement must play an important role in evaluating effects of fine sediments on salmonid habitat in the northern Rockies" (p. 258). They added that "Regulatory agencies may have to provide interim criteria for non-point source sediment delivery to salmonid habitat", pending the findings of future studies.

The State of Idaho is currently developing such criteria to judge whether forest practices (and other nonpoint sources) are adversely affecting beneficial water uses. Four separate criteria are being proposed to cover impacts both on fisheries and drinking water (Idaho 1988b). These criteria include: turbidity limits for effects on public water supplies; intergravel fine sediment/dissolved oxygen concentrations for effects on salmonid reproduction; turbidity limits for effects on fish feeding ability; and sedimentation (embeddedness) for effects on salmonid. If these criteria are adopted through formal rulemaking proceedings by the Idaho Board of Health and Welfare, Idaho will have measurable standards to indicate when forest practices have impaired beneficial uses and thus violated water quality laws.

B. BEST MANAGEMENT PRACTICES

The draft "Best Management Practices for Forestry in Montana" (Appendix H) were developed by the Best Management Practices Technical Committee as a comprehensive set of the minimum practices necessary to protect water quality and beneficial uses. The committee approved 90 separate management practices in five major categories: roads (including planning and location, design, drainage from road surface, construction, and maintenance); timber harvesting (including harvest design, harvest practices, streamside management and site preparation); stream crossings; winter logging; and hazardous substances. Definitions for "stream", "streamside management zone", and "wetlands" were also adopted.

The BMPs generally represent the consensus of a committee that included specialists from a range of interests and technical backgrounds. On some points there was considerable discussion over how much specificity should be included in the language for specific BMPs. The debate hinged on finding the appropriate balance between the need for flexibility to allow a timber operator to respond to site-specific conditions and the need for "bottom-line" guidance to prevent watershed damage.

The timber sale audits highlighted two subject areas where improved attention to BMPs appears warranted. Streamside management practices received the lowest overall ratings for effectiveness in conserving watershed values. On some timber sales, audit teams found exemplary practices while in others, streamside values were severely compromised. The teams also found inconsistencies in streamside practices within individual timber sales -- in one, for example, a considerable soil protection zone was maintained along a large stream, but the use of heavy equipment for harvesting and site preparation caused extreme disturbance along a smaller perennial stream.

These findings indicate a lack of understanding of the efforts necessary to achieve soil and water conservation goals in this sensitive area. They may also indicate the need for clear and consistent guidelines so operators know what is expected when harvesting timber in the streamside management zone (SMZ).

The draft BMPs for streamside management (Appendix H, pages 7-8) caution operators to "minimize operation of wheeled or tracked equipment within the SMZ", which by definition should be at least 25 feet wide. The BMPs also list a range of practices to consider when harvesting timber in the streamside zone, including retention of unmerchantable vegetation and bank-edge trees; limits on the length of streamside clearcuts; maintenance of ground cover to trap sediments; and prevention of broadcast burning through the SMZ.

The streamside management guidelines used by the Montana Department of State Lands and the forest practice rules in Idaho, Washington, Oregon, and California (Appendix G) are considerably more specific and comprehensive than the streamside considerations listed by the HJR 49 Best Management Practices Technical Committee. Management practices in these other jurisdictions include a wider minimum zone where heavy equipment is restricted; a specified number and size of trees to be left standing within the streamside zone; restrictions on burning; and requirements for on-site marking of streamside zone width. The state laws also require prior approval (often accompanied by on-site inspections) before certain practices can be conducted within the streamside zone.

These stricter BMPs reflect increasing regional concern over the adverse effects of poor streamside management practices. They also reflect increasing knowledge about the role of streamside zones in conserving stream integrity (e.g., WDNR 1987). In the last two years, Washington and Oregon have completed major revisions of their forest practice rules for streamside zones, and much of the revisions have been based on new findings related to the role of large organic debris in stabilizing streambeds and banks, providing fisheries habitat, and controlling the storage and movement of sediment through the stream system. Idaho officials are also proposing a "leave tree" requirement to ensure that streamside logging will not eliminate trees required for stream channel integrity.

The Montana Riparian Association, an organization of university, state, federal, state and private agencies involved in riparian management and research, is also working toward improving understanding of streamside zone/timber management interactions. The association has recently completed habitat classifications for riparian forest types and is beginning a project to develop habitat-specific management guidelines.

In sum, there is a growing understanding that streamside management practices are crucial to stream values, a demonstrated need to improve timber management practices in the streamside zone, and an extensive and developing body of knowledge on appropriate streamside management practices. At the same time, there is no mechanism in place to ensure that this information will be used to define or promote appropriate streamside management practices on-the-ground in Montana. Options to achieve this incorporation are outlined in the discussion of Issue #2 in Section VIII of this report.

Road drainage represents a second area where management practices received relatively low marks during the audits. In contrast to streamside considerations, however, road drainage BMPs are well established and have not been subject to many recent advancements through research. Rather, the key for effective road drainage is largely a matter of ensuring that site

conditions are well understood and that known and accepted techniques are applied.

Improved sale administration and oversight would address a number of the observed problems related to many road drainage practices, including the need for timely installation of road drainage on new roads and the maintenance of road drainage features. Improved education is indicated for other road-related BMPs. For example, the timber sale audits indicated that some operators were not aware of the need to channel road drainage through a streamside zone (to filter sediments), rather than running ditches directly to a stream crossing. Constructing "slash filter windrows" at the base of road fill slopes during road building is a practice that can have economic benefits to operators (reducing the need for slash removal), as well as water quality improvements. Again, educational efforts are indicated to improve operator knowledge of this practice.

Overall, the BMPs developed through the Best Management Practices Technical Committee are intended to serve as a solid educational tool for landowners and timber operators in Montana. There will be a continuing need, however, for forest managers to keep up with new information, to educate to landowners and operators, and to improve on-the-ground implementation in some key areas.

C. PROGRAMMATIC APPROACHES TO THE FOREST PRACTICES/WATERSHED ISSUE

1. Promotion of Best Management Practices in Montana

The U.S. Environmental Protection Agency has recognized best management practices as the "primary mechanism to enable the achievement of water quality standards" for nonpoint sources of pollution (EPA 1987). Nonpoint control programs (whether regulatory or voluntary) must address each of the necessary links in the chain connecting the BMP concept to on-the-ground practices that conserve watershed values during resource development. In the discussion that follows, Montana's program is evaluated based on the integrity of six separate links.

The first link consists of appropriately written best management practices. The BMP package initiated by the Montana Cumulative Watershed Effects Cooperative (MCWEC) and further developed through HJR 49 covers the range of practices employed by timber operators, and provides considerable flexibility in the application of practices to meet site conditions. As discussed above, however, the lack of specificity in streamside zone practices may represent a shortcoming in the BMPs.

The second link is education to ensure that landowners and operators are knowledgeable about forestry BMPs. Educational efforts in Montana include in-house staff training by federal agencies and by the DSL Forestry Division and a forum for

communication on BMPs with industrial private timber companies through the MCWEC. BMP education for nonindustrial private landowners and logging operators is very limited, however, with no formal training programs in BMP application currently offered by the state for the private sector.

The third link in the BMP chain is a commitment by the landowner to include BMPs in sale planning and layout. BMPs represent a preventative approach to watershed management, and many problems can be avoided with careful attention in advance of site development to items such as road location, the appropriate timing for installation of erosion controls, and harvest specifications and techniques for streamside zones. This commitment to use BMPs can be developed through pre-sale consultations, but nonindustrial private landowners receive private forestry assistance in only about 10% of the 750-900 nonindustrial private timber sales annually harvested in Montana. Although industrial private and federal landowners are knowledgeable about BMPs, some of the problems discovered through the timber sale audits on these lands could have been avoided with appropriate consideration of BMPs in pre-sale planning.

Implementation is the fourth link between the BMP concept and watershed conservation. The best written BMPs, education efforts, and timber sale planning can be undone in a few minutes by a careless operator. This was evident on several of the audited timber sales, where sale administrators were dismayed to find that practices used by an operator did not conform with the administrator's expressed desires. Logging contracts which include BMPs are one way to improve compliance, but in many cases it is neither practical nor cost-effective for a landowner to seek legal redress for a contractor's failure to apply BMPs.

Failure to effectively apply BMPs may be a result of economic considerations by the landowner in not planning to use BMPs; economic considerations of the timber operator in not carrying them out; or a lack of education of the landowner or operator. To limit the likelihood of poor management practices and the potential for adverse watershed effects, oversight then becomes the fifth link in the BMP chain. This oversight has been characterized as "implementation monitoring" by the Forest Service (Solomon and Avers 1987) and "monitoring to ensure that practices are correctly designed and applied" by the Environmental Protection Agency (EPA 1987).

Montana's oversight of forest practices on private lands is minimal. The Department of State Lands does not have program responsibility or staff to oversee watershed concerns related to logging practices on private lands. DSL's on-site inspections under the fire hazard reduction program are generally limited to slash disposal considerations. The Water Quality Bureau, with only a half-time position allocated to forest practice issues, conducts site visits only as part of complaint investigations or special projects. Conservation districts, the designated

nonpoint source water quality management agencies for state and private lands, do not have active programs to address forest practices. As a result, there is virtually no state monitoring of the implementation of forest management practices.

It has been argued that state water quality laws, with their stringent enforcement authority, are adequate to compel landowners to institute best management practices, and thus are an effective substitute for oversight of logging operations. This contention, however, is not readily supportable. Certain water quality parameters for nonpoint sources apply only when operators are demonstrated not to be using "reasonable" practices, or to situations where beneficial uses have been damaged. The standards include little guidance on what constitutes "reasonable" practices and no methods or criteria to define impairment of beneficial uses; each criterion is potentially subject to court challenge. More importantly, enforcement along these grounds can only occur after damage has been done. The Water Quality Act prohibition against "placing waste in a position where it may cause pollution" is potentially a pro-active tool to prevent water quality degradation, but there is no formal inspection program that would reveal potential problem sites or encourage BMP use.

The sixth link in achieving BMP implementation is the evaluation of the effectiveness of applied BMPs in meeting water quality standards. This program element, emphasized by EPA in its guidance on nonpoint source pollution controls, falls within the responsibilities of the Water Quality Bureau. The issue was clearly framed in a recent letter (Pilcher 1987) from the bureau to the Beaverhead National Forest, stating:

> "In conclusion, land management activities that are in compliance 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."

The bureau has not, however, insisted that private land managers have such monitoring in place and the bureau's own limited resources preclude an active state role in evaluating BMP effectiveness. As stated by WQB in response to a recent survey on nonpoint source control programs:

> "The greatest limitation in addressing nonpoint source water quality problems is a lack of funding for implementation. . . . There is a need for increased resources to devote toward monitoring and assessment of nonpoint problems. Many of the sedimentation problems . . . are not well characterized and documented. An increased emphasis upon biological monitoring is warranted to better assess impacts of sedimentation . . . Resources are also needed to better

evaluate the effectiveness of management practices which are implemented; to assess whether BMP implementation is taking place; and to support a staff who maintain the visibility and concern for maintaining water quality as a consideration in how we do business and manage our lands" (ASIWPCA 1985).

2. Recent Initiatives in Montana

The preceding review outlines several weak links in the chain connecting the BMP concept to effective BMP implementation in Montana. Education for timber operators and nonindustrial private landowners; pre-sale assistance and contact with all private landowners to ensure BMPs are incorporated into sale design; oversight of management practices; and evaluation of BMP effectiveness are all topics receiving inadequate attention.

The Department of State Lands has advanced two proposals to address the needs for education and pre-sale assistance. The first proposal is an application to the Renewable Resource Development Program, requesting a $90,000 grant for a two-year "Forestry BMP Education Project." The project would develop educational materials and conduct workshops for loggers, logging contractors, foresters, landowners, conservation district officials, and state agency staff. The project also proposes to evaluate the success of the educational approach in meeting forest watershed objectives.

The second DSL proposal involves four major elements: (1) designation of DSL as the nonpoint source water quality management agency for forestry; (2) a commitment of state resources so the department can hire adequate staff (about 6 employees) to carry out this role; (3) enactment of legislation to require that landowners/timber operators notify the state prior to the conduct of forest practices; and (4) a pre-harvest inspection by DSL foresters with nonindustrial private landowners to review proposed timber sales and ensure that BMPs are included in sale planning and layout.

This DSL proposal incorporates the main elements of a task force report by the Montana Society of American Foresters (SAF). In calling for a pre-harvest notification requirement, the SAF task force noted:

> "We feel that an entirely voluntary program will never attain the educational objectives we seek. At a minimum, it is necessary to adopt a legal requirement that private forest landowners contact the Department of State Lands for information and on-site evaluation prior to selling or cutting timber. The primary purpose of this evaluation would be to explain to the landowners the benefits and proper use of BMPs on their specific site. It would also provide an opportunity to make the landowner aware of the value of a written timber sale contract and the possible need for the services of a private consulting forester.

There would be no requirement for mandatory compliance with department recommendations or BMPs and no compliance inspections. Implementation would be solely at the discretion of the landowner" (Frissell 1988).

In its recent Nonpoint Source Management Plan, the Water Quality Bureau has proposed to establish a forest practices review committee for education, monitoring and consultation on the direction of Montana's nonpoint source program for forestry. The committee would be an outgrowth of the HJR 49 technical committees, which will terminate at the close of the Environmental Quality Council study. The committee would help promote BMP implementation and could serve as a review panel for proposed changes in specific management practices in the event that monitoring or other information indicates watershed resources are not being adequately protected.

The Flathead Basin Forest Practices, Water Quality and Fisheries Cooperative Program represents another initiative to develop information on forest watershed management in Montana. The cooperative, established by a July 1988 memorandum of understanding, is coordinated by the Flathead Basin Commission, with other participants representing the Department of State Lands, Water Quality Bureau, Flathead National Forest, University of Montana, Plum Creek Timber, and the Department of Fish, Wildlife and Parks. The purposes of the cooperative are (1) to document, evaluate and monitor the effects of forest practices on water quality and fisheries within the Flathead Basin, and (2) to establish a process to utilize this information to mitigate any potential adverse effects. Study leaders from a variety of disciplines will carry out specific research efforts to address the scientific questions; land managers participating in the cooperative will be able to apply the findings to management situations. Overall the study should provide new information on the application of BMPs in the Flathead region and the effectiveness of BMPs in protecting water quality and beneficial uses. Study results are expected to be used by regional land managers through a process of adaptive management to alter forest practices to address watershed concerns.

3. The Idaho Model and the Montana Challenge

The Idaho Forest Practices Water Quality Management Plan (Idaho 1988a) is an excellent example of a programmatic approach to addressing nonpoint source water pollution from forestry. The Idaho program includes 11 separate elements, reflecting the implementation of the Idaho Forest Practices Act by the Idaho Department of Lands and oversight by the Idaho Water Quality Bureau. These program elements consist of:

* forest practice notification for operations on state and private lands;

* inspections of activities on state and private lands;

* enforcement of forest practice regulations;

* training and education;

* a process to evaluate and, if necessary, revise best management practices to ensure their effectiveness;

* random forest practice audits (every four years);

* ongoing forest practice audits by state and federal agencies;

* coordination of water quality monitoring among state and federal agencies;

* development of a forum to consider cumulative effects in mixed ownership drainages;

* establishment of water quality criteria to determine when beneficial uses are being impaired by nonpoint source pollution;

* an annual report evaluating the performance of the designated management agencies in meeting forest watershed objectives, and containing recommendations for any necessary improvements.

Although Montana agencies undertake portions of the Idaho program, many of these elements are missing in the Montana program and there is no comparable interagency "package" approach. Resource limitations are again key to the program differences between the two states. The Idaho Water Quality Bureau has regional field offices, and employs three full-time professionals who review planned timber sales in priority watersheds, conduct field audits of BMP effectiveness, and undertake water quality monitoring to determine the effects of forest practices. The Idaho Department of Lands employs a field staff of 10 foresters to oversee compliance with forest practice rules on private lands. The annual budget to implement the forest practice act is about $532,000, with funding provided from a tax on private forest land, general fund appropriations, and a dedicated state natural resource fund.

While the Idaho program is based on mandatory forest practices rules, it is important to note that enforcement is only one element of the total package. Efficient use of resources is a key aspect, with a field inspections directed to high priority areas, including high hazard areas, streams with sensitive beneficial uses, and areas where damaging operations have been reported. Education and training are also important nonregulatory elements, and well-defined interagency roles are integral to the success of the program.

The challenge for Montana is to craft a forest practices watershed program with the appropriate elements to meet forest watershed management goals within realistic funding constraints. The evaluation of policy options in Chapter VIII outlines some of the approaches that may help meet this challenge.

VII. CONCLUSIONS

Information gathered through the study of forest practices and watershed effects under House Joint Resolution 49 supported the following conclusions:

A. Watershed Effects

* There is little quantitative information available on the effects of forest practices on watersheds in Montana.

* Evaluation of the application and effectiveness of best management practices to assess the watershed effects of forest practice is presently an appropriate and feasible surrogate for either direct water quality measurements or direct measurements of beneficial use impairment. However, in the near future some useful direct measures of the impacts of forest practices on beneficial uses (primarily concerning the relationships between instream sediment and fisheries) may emerge.

* Audits of management practices on 38 Montana timber sales indicated that timber operators properly applied a large majority (82%) of the total number of management practices, and there were virtually no instances of gross neglect of BMPs.

* About 5% of management practices were characterized as major departures from BMPs; a slight majority of timber sales had at least one major departure and these sales averaged more than two major departures. Another 14% of the practices were rated as minor departures.

* Failure to properly apply BMPs generally resulted in a failure of the practice to prevent the movement of sediment into streams. Minor departures generally led to minor effects, while major departures generally caused major impacts.

* In 16 of the 38 sales, audit teams characterized at least one practice as having major detrimental impacts on soil and water resources. Impacts were projected to be extensive and long-term in 5 of these sales, while in the remaining 11 sales the major impacts were considered to be primarily short-term.

* Management of streamside zones received the lowest overall rating for application and effectiveness of BMPs.

* BMPs relating to road drainage and erosion control practices had a high frequency of misapplication, with 35% rated as departures (25% minor and 10% major).

* The degree to which best management practices were applied was similar among nonindustrial private, industrial private and federal lands. The limited sample of state-owned timber sales indicated a higher degree of compliance with BMPs.

* There is little available information in Montana indicating the degree to which multiple forest practices in a drainage have resulted in adverse cumulative watershed effects. Qualitative examples of damage have been cited, however, and there is a concern among watershed specialists that cumulative effects must be seriously considered as headwater areas are brought under timber management.

B. Best Management Practices

* Best management practices are considered the primary means of meeting water quality goals for nonpoint sources of pollution.

* The best management practices developed through the Best Management Practices Technical Committee (BMPTC) during the HJR 49 study generally represent a consensus approach among technical specialists representing various perspectives on forest watershed issues.

* Debate remains over how much specificity is desirable in the language for individual BMPs. This debate hinges on finding the appropriate balance between the need for flexibility for the operator conducting forest practices versus the need for "bottom-line" guidance to prevent watershed impacts.

* Streamside management zones are defined as zones of carefully managed activity, rather than zones of exclusion of timber harvest.

* Best management practices developed through the BMPTC for the streamside management zone are considerably more general than the streamside (riparian) management requirements of neighboring states. It can be questioned whether the level of operator discretion provided for in the BMPTC streamside management practices is adequate to protect water quality or stream quality, especially in light of the audit findings related to streamside management practices and effects.

C. Legal and Administrative Structure to Promote the Use of BMPs and to Address Forest Practices and Watershed Effects in Montana

* Achieving proper application of management practices to conserve watershed values involves a number of links, including appropriately written BMPs; knowledge of the BMPs by landowners and operators; a commitment to include BMPs in sale planning and layout; and proper application of BMPs on-the-ground. Effective state programs should be designed to address each of these links through a combination of agency responsibility for BMPs; information/education; pre-sale assistance; prioritization of efforts to ensure protection of sensitive areas; oversight of BMP application; and monitoring of BMP effectiveness.

* Montana's program to address forest practices and watershed effects has a number of strengths, including voluntary efforts by timber industry representatives to adhere to and promote BMPs; mandatory contact between private landowners and the Department of State Lands through the hazard reduction program; a cooperative working relationship between state agencies and industry; involvement of local conservation district officials in stream crossing permits; internal audits of management practices by state, industrial private, and federal agencies on lands under their respective jurisdictions; and a newly developed procedure to address cumulative watershed effects.

* Montana's program to address forest practices and watershed effects has major weaknesses, including the lack of any formal governmental oversight of private forestry operations (with the exception of complaint investigation under the Water Quality Act); limited participation of small private landowners in the private forestry assistance program and thus little pre-sale assistance; a very limited educational program on watershed effects for landowners and timber operators; a lack of resources and technical expertise among conservation districts to carry out their role as the designated nonpoint source water quality managers for Montana; the absence of a procedure (involving at least agencies and industry) to identify and address high-priority issues, such as proposed logging in environmentally sensitive watersheds; the absence of monitoring to assess the effectiveness of BMPs; and the absence of systematic efforts to assess the impacts of forest management on beneficial uses or to incorporate the findings from other states on this subject. These weaknesses, primarily based on a shortage of staff and financial resources at the state and local levels, preclude Montana from effectively implementing a

preventative approach aimed at minimizing potential damage to forest watersheds.

* It is inappropriate to depend on state water quality standards to ensure compliance with forest practice BMPs. State water quality standards apply only to operations that can be demonstrated not to be using "reasonable" practices, or to situations where beneficial uses have been damaged. The standards include little guidance on what constitutes "reasonable" practices and no methods to define impairment of beneficial uses; each criterion would likely be subject to court challenge. More importantly, enforcement along these grounds can only occur after damage has been done. The water quality act's prohibition against "placing waste in a position where it may cause pollution" is potentially a pro-active tool to prevent water quality degradation, but there is no formal inspection program that would reveal potential problem areas.

* State forest practice acts include some of the program elements outlined above as absent in Montana. Pre-notification requirements prior to the conduct of timber sales are intended to allow state officials to adopt a pro-active, rather than reactive posture. Enforcement provisions based on inspections of BMP application, rather than on water quality laws, are intended to provide legal authority to prevent potential watershed problems. Forest practice acts, however, carry considerable administrative costs for state government and for industry. Although they are generally thought to result in improved practices, policymakers must obviously balance the costs versus the benefits of enacting a forest practices program based on mandatory BMP compliance and enforcement.

* Federal agencies are appropriately designated the role of managing nonpoint source pollution on their lands. These agencies have the legal mandates and generally the resources to address potential watershed concerns. Additional attention by these agencies to oversight of forest management practices may be warranted, given the findings of the HJR 49 audit teams.

* An "adaptive management" approach, as has been used in the forest practices program in Washington and in the management of various other natural resource issues (and as is being developed through the Flathead Basin Commission's Forest Practices/Water Quality and Fisheries Cooperative Program), may be appropriate for Montana to consider for certain watershed values affected by forest practices. An adaptive management approach involves cooperative research, monitoring, and

evaluation (generally by state agencies, industry, and other interested and technically qualified parties) to gain a better understanding of specific natural resource interactions and to adapt management practices when demonstrated as necessary.

VIII. EVALUATION OF RESPONSE OPTIONS

There are a variety of policy options that may be considered in response to the conclusions presented on watershed effects, best management practices, and the administration of a state forest practices water quality program. The options outlined below range from maintaining the status quo to restructuring state programs along a variety of lines. For each option, advantages and disadvantages are briefly presented.

Several options were developed by agencies or organizations participating in the HJR 49 study, and these sources are noted. The evaluation, however, does not attempt to characterize the array of political considerations relating to any of the options -- for example, support or opposition by certain interests. These factors will be considered by the Environmental Quality Council and the Legislature in their deliberations on the policy questions.

The options presented for each issue are not necessarily exclusive of one another. In many cases, it may be possible to combine options or elements of options to develop a response to a particular issue.

Issue #1: What is the most appropriate means for Montana to promote the use of best management practices in forest management?

Options:

A. Continue current programs, direction and allocation of resources.

Advantages:

* No additional commitment of state or private resources is necessary.

* This approach continues current strengths of the Montana program, including voluntary efforts by the timber industry to promote and adhere to BMPs; a cooperative working relationship between DSL and industry; and the adoption of a procedure to address potential cumulative effects in mixed ownership drainages through the Cumulative Watershed Effects Cooperative.

* Conservation districts are designated as nonpoint source managers currently and would be appropriate local entities to conduct nonpoint source management programs if funds are eventually allocated under section 319 of the Clean Water Act.

* Private landowners are able to conduct their operations using current practices and with minimal governmental oversight.

Disadvantages:

* There will be no improvement in program elements currently viewed as weaknesses in Montana's forest practices water quality management program. These elements include: the lack of governmental oversight of private forestry operations; limited participation by small private landowners in the DSL private forestry assistance program; a limited BMP educational program for landowners and operators; the absence of procedures to identify private forest practices planned for sensitive watersheds and to implement mitigation efforts; the absence of monitoring to assess BMP effectiveness; and the absence of efforts to assess the effects on forest management on beneficial uses.

* This approach relies on the Water Quality Act as the backup for watershed protection if BMPs are not used; however, the Water Quality Act is generally applied only after watershed damage can be demonstrated.

* Improvements in practices will be achieved largely to the extent that efforts by industry are successful in promoting BMP use. There will be no state resources to determine the degree to which these voluntary efforts are succeeding.

B. Adopt a forest practices act, including appropriating funds to the Department of State Lands to adequately implement and enforce a forest practices program.

Advantages:

* The possibility of enforcement provides a strong incentive for landowners and operators to conform to BMPs, resulting in better resource protection.

* Enforcement is based on compliance with forest practices, rather than on water quality damage.

* Pre-harvest notification of DSL by the landowner (generally required through a forest practice act) provides an opportunity for state officials to inspect the site and work with operators in advance of or during an operation to mitigate potential watershed effects.

* A Board of Forestry (included as the rulemaking authority in most forest practice acts) would provide a

focal point for discussion and improvement of forest practice rules.

Disadvantages:

* Considerable costs will be incurred by state government to administer the program (an estimated 10-12 FTEs for DSL, or about $500,000 per year).

* Forest landowners will incur new costs in complying with the regulations adopted under a forest practices act.

* Enforcement actions can dampen the positive relationships between DSL and representatives of private industry.

C. Designate the Department of State Lands as the agency charged with implementing nonpoint source water pollution control for private forestry operations; enact legislation requiring private landowners to notify DSL prior to initiating forest practices; use DSL foresters to inspect timber sale locations in order to review BMPs and sale layout with the landowner prior to the conduct of forest practices; increase education and training efforts for private landowners and operators, including the funding of a Forestry BMP Education Project submitted to the state Renewable Resource Development Program; retain a voluntary compliance structure (i.e., no enforcement authority for failure to utilize BMPs).

[Department of State Lands proposal, largely incorporating a draft position paper by the Montana Society of American Foresters to implement an approach combining notification, education, and voluntary compliance.]

Advantages:

* DSL is an established point of contact with private landowners through its responsibilities under the hazard reduction and private forestry assistance programs.

* The educational elements of the program will help insure that timber operators and landowners are better informed about BMPs.

* DSL already conducts post-logging site inspections under the hazard reduction program. This proposal would add another inspection before forest practices are initiated, and would ensure that the inspecting foresters address watershed considerations.

* DSL has field offices in the forested areas of Montana and employs staff experienced in applying and evaluating forest management practices.

* Designation of DSL as the implementing agency for nonpoint source control would establish a formal role for DSL to oversee private forest management practices.

* DSL could evaluate the application and effectiveness of BMP application, based on the findings of the post-logging inspections, and make this evaluation available for legislative review.

Disadvantages:

* DSL would need additional staff to carry out this responsibility (an estimated 6 FTEs or about $300,000 per year).

* The designation of DSL as the state nonpoint source management agency would not carry any enforcement authority. It is unclear what penalties would apply to landowners or operators for failure to file notification of a proposed forest practice.

* The voluntary approach may not provide an adequate incentive for private landowners to spend the time and money necessary to do the job right.

* DSL foresters have a stronger background and interest in forest management than in water quality issues. The proposal does not include formal participation by water quality or fishery specialists to provide input on proposed practices or on the evaluation of BMP effectiveness.

D. Encourage conservation districts to actively undertake their role as the designated nonpoint source water quality managers for forestry. Provide funding to conservation districts with active forestry operations and also make available a corps of state employees with technical expertise in forestry/watershed/fishery issues to assist CD staff on request.

Advantages:

* This proposal provides a local presence to oversee logging operations, to identify local watershed concerns, and to provide assistance with sale layout and BMP application.

* This approach builds on the successful model of the 310 permit process, which involves local officials, the

landowner, and fisheries biologists to develop appropriate stream crossings.

* State financial and technical assistance would help overcome the wide variation in financial capabilities of districts to operate a forest practices program.

Disadvantages:

* The program would entail new costs for conservation districts, and a dedicated funding source would need to be found to cover these costs. In addition, conservation districts do not have the personnel to keep up with the increased workload that could result from this proposal.

* The program would entail new costs for state government in providing financial and technical assistance to the conservation districts.

* Conservation district members may be reluctant to provide a critical review of practices conducted by neighbors or major employers in the community.

E. Institute timber operator licensing or certification requirements, based on an educational program and testing for knowledge of BMPs.

Advantages:

* This approach targets information/education efforts at those persons doing the logging.

* This approach can be combined with other elements in a state forest practices water quality management program.

Disadvantages:

* The state would incur administrative costs to conduct the program.

* Timber operators would incur costs in becoming licensed or certified.

* Unless combined with other efforts, this approach ignores the small private landowner, who ultimately is in the position of evaluating and living with the effects of the logging activity.

* Unless combined with other efforts, this approach singles out one element of the timber industry for regulation.

F. Encourage (or compel) the Board of Health and Environmental Sciences to adopt rules establishing enforceable best management practices for forestry. [Authority for this rulemaking apparently exists under the Water Quality Act if the rulemaking were used as a means of defining "reasonable land, soil and water conservation practices".]

Advantages:

* This approach establishes mandatory minimum requirements for forest practices, and could improve forest practices.

* In the event BMPs are not utilized, enforcement action may be taken in advance of resource damage.

Disadvantages:

* Adopting regulations, in the absence of the staff and resources to implement a full program of education, oversight and enforcement, does little to educate landowners and operators. This approach can lead to uneven enforcement and confusion among the regulated community.

* Enforcement provisions of the Water Quality Act may not be tailored to the kinds of violations commonly occurring in forest practice operations.

* Enforcing regulations governing management practices (in the absence of obvious water quality degradation) would likely be a low priority for water quality officials.

G. Establish a network of regional water quality managers within the Water Quality Bureau to develop nonpoint assessments and management plans in their region; oversee and provide technical assistance on forest practices and other nonpoint source activities; monitor BMP compliance; conduct water quality monitoring; investigate complaints and water quality violations; and work with other agencies and organizations involved with nonpoint source issues.

[Clark Fork River Basin Project proposal, as contained in the project's December 1988 final report]

Advantages:

* Regional water quality managers would be able to provide technical, project-level assistance and oversight to timber operators in order to protect water quality and beneficial uses.

* The network would substantially increase state capabilities to enforce the water quality act.

Disadvantages:

* The regional water quality managers would not necessarily have forestry expertise, and would need to coordinate with other agency personnel.

* Instituting a regional water quality program with 4 managers would cost about $200,000 per year.

H. Enact legislation to provide tax incentives to forest landowners who enter a binding agreement to use best management practices and to comply with watershed-specific management plans developed in conjunction with DSL and WQB.
[modeled after provisions of House Bill 781 from 1987]

Advantages:

* This approach would provide a "carrot" for landowners to use BMPs, and might elicit more compliance than a regulatory or voluntary program.

* This approach would allow the state to establish watershed-specific management plans among interested landowners to mitigate on-site impacts and potential cumulative effects in a drainage.

Disadvantages:

* A certification and recordkeeping process would be required to assess the compliance status of lands applying for tax incentives.

* DSL and WQB would need additional staff to administer the program.

* The watershed agreements might encourage landowners to refrain from offering timber for sale at a time when Montana is facing a shortfall in timber supply.

* A tax reductions would have a negative impact on the state treasury.

I. Establish a state-level interagency, interdisciplinary team (or teams) including a water quality specialist (DHES), a fisheries biologist (DFWP) and a forester (DSL) to review proposed timber sales and work on a voluntary basis with the landowner to mitigate impacts. A pre-harvest notification would be required as part of this alternative, and post-harvest assessments of impacts would be carried out.

Advantages:

* This approach would bring a variety of disciplines to bear in addressing potential forest watershed impacts.

* This approach would allow state officials to prioritize their action and focus on mitigating potential effects in the most sensitive locations.

* This approach would improve inter-agency cooperation and the exchange of ideas in relation to forest practice, watershed effects, best management practices, and the needs of the forest industry.

Disadvantages:

* From 3 to 6 new FTE's would need to be hired ($120,000 - $240,000 annually).

* The presence of a state interdisciplinary team might have an intimidating effect on landowners, even though compliance would be voluntary.

Issue #2. How can Montana improve the conduct of forest practices in the streamside management zone?

Options:

A. Continue current programs.

Advantages:

* No additional resources would have to be devoted to this issue.

Disadvantages:

* No improvement in streamside practices would be anticipated.

* Based on the audit findings, the potential for damage to watershed values would remain high.

B. Enact legislation to authorize the Department of State Lands or the Water Quality Bureau to adopt rules governing forest practices in the SMZ.

Advantages:

* Legally enforceable rules could improve management practices in the streamside zone and help conserve watershed values.

* Defined standards would eliminate confusion over acceptable practices in the SMZ.

* Rulemaking proceedings provide a forum for technical input on the SMZ issues, so issues like "leave trees" and the appropriate width of a soil protection zone can receive ample technical consideration.

Disadvantages:

* Rules can constrain the ability of timber operators to effectively and efficiently respond to variations in site conditions.

* Rules can have negative economic impacts if they restrict the amount of timber that can be harvested in the SMZ.

* Rulemaking proceedings can polarize interest groups, and result in testimony pitting scientist against scientist on issues where current information is not definitive.

C. Enact legislation amending the Natural Streambed and Land Preservation Act to provide for review and permitting of forest practices in the SMZ by the conservation districts.

Advantages:

* On-site visits to streamside zones in advance of timber sales offer the opportunity and incentive for landowners and operators to include BMPs in pre-harvest planning to prevent potential watershed impacts.

* Recommended practices can be tailored to the conditions discovered during the on-site review.

* An interdisciplinary approach involving Fish, Wildlife and Parks staff in 310 inspections has proven effective in dealing with water quality and fishery concerns.

Disadvantages:

* The 310 permit process can take up to 60 days and thus delay planned harvests.

* Conservation districts would need additional financial and/or personnel resources to carry out this task.

* Unless standard procedures are developed for evaluating and recommending streamside BMPs, approved practices could vary widely in different regions of the state.

D. Work through the Montana Riparian Association to develop SMZ guidelines.

Advantages:

* The Montana Riparian Association (MRA) is currently working to develop appropriate management practices for a variety of riparian forest habitats in Montana.

* The MRA process will involve technical specialists from a variety of agencies and organizations in the development of the streamside practices.

* MRA's goal is to develop practices that can be understood and applied by persons without extensive technical backgrounds (i.e., private landowners and timber operators).

Disadvantages:

* The MRA process will not be completed for several years.

* There would still be a need for education and oversight to ensure that the streamside guidelines are applied.

* The MRA does not have a formal decision-making procedure to deal with potential conflicting opinions on appropriate streamside practices.

* The MRA process is not currently addressing issues relating to long-term stream structure (e.g., leave trees).

E. Work through the administrative structure selected in response to Issue #3 below.

See the advantages and disadvantages listed for each option below.

Issue #3. What administrative structure should Montana utilize to resolve a range of forest watershed technical issues (streamside management, monitoring of BMP effectiveness, criteria for effects on beneficial uses, and cumulative effects) and to oversee and report on the progress of nonpoint source control efforts for forestry?

Options:

A. Continue current program structure and responsibilities.

Advantages:

* No additional resources would be needed.

Disadvantages:

* There is no state agency or interagency group with the resources or responsibility to address this range of forest watershed issues in a comprehensive manner.

B. Direct the formation of a new interagency group, consisting of the Department of State Lands, Water Quality Bureau, and Department of Fish, Wildlife and Parks, to address these issues and develop recommendations on the specific roles each agency should play in a forest practices watershed program.

Advantages:

* This effort could improve interagency cooperation, better define roles based on legal responsibilities and agency resources, institute data gathering and reporting responsibilities for program elements currently not covered (e.g., use of BMPs in private forest management operations), and serve as a forum for making decisions on technical issues that cross various disciplines (e.g., streamside management -- which involves forestry, water quality and fisheries).

* The interagency group could also promote an "adaptive management" approach, using research findings to adjust management policies.

Disadvantages:

* Agencies would have to "borrow" staff from current programs to conduct this effort or seek additional funding.

C. Enact legislation authorizing the governor to appoint a forest practices advisory committee charged with addressing these issues and developing recommendations.

Advantages:

* An advisory board could be an appropriate body to receive testimony and advise the executive branch on appropriate policy direction.

Disadvantages:

* Advisory boards often reflect a political rather than technical composition.

* An advisory board would be dependent on the technical work of agency staff, and thus could serve as another layer through which technical findings would have to be filtered.

D. Request the Montana Cumulative Watershed Effects Cooperative address these issues.

Advantages:

* There is a good working relationship among members of the cooperative, representing a variety of state and private organizations.

* This forum has made progress on cumulative effects.

Disadvantages:

* There is no assurance that the members of the cooperative would have an interest in addressing or resolving these technical points.

* The cooperative does not cover the entire state.

* The cooperative does not include broad public participation.

* Participants in the cooperative may not be able to make the commitments of time and staff necessary to work on these highly technical issues.

E. Continue the HJR 49 study.

Advantages:

* The study has developed good working relationships among various groups involved in the forest watershed issue.

* A legislative study provides a good forum for public discussion of policy issues.

Disadvantages:

* Other agencies that are administering forest watershed programs and relevant state laws would be in a better position to explore these technical/policy issues.

* The EQC study has gone on for over a year, and has already required a large investment of time and energy by participants.

* The 1989-91 Environmental Quality Council may have priorities other than forest watershed management, particularly as the issues become more technical in nature.

IX. SUMMARY OF ACTIONS: ENVIRONMENTAL QUALITY COUNCIL MEETING, DECEMBER 9, 1988

The Environmental Quality Council met in Helena on December 9, 1988, to develop recommendations for its interim study on forest practices and watershed effects under House Joint Resolution 49. Following public testimony on the HJR 49 draft report, EQC members considered the primary study question:

> "How should Montana structure a program to promote the use of best management practices for private forestry?"

The EQC discussion was organized to address six potential elements of a forest practices water quality program: best management practices; information and education; pre-sale assistance; oversight of BMP application; technical issues; and follow-up. A brief recap of Council action on each element is provided below.

A. Best Management Practices

EQC adopted a motion generally endorsing "Best Management Practices for Forestry in Montana" (developed by the HJR 49 Best Management Practices Technical Committee) as the foundation for a consistent statewide set of forestry BMPs.

EQC adopted a motion recognizing the Department of State Lands as the lead agency to:

* achieve consensus on a final BMP package by resolving among study participants outstanding issues related to streamside management zones and other topics;
* publish and promote these BMPs as the best management practices for forestry in Montana; and
* establish a procedure, including participation by landowners, for considering and adopting changes to specific BMPs.

B. Information and Education

EQC endorsed the Department of State Lands as the lead agency to organize educational programs and training workshops on BMPs for timber operators, landowners, timber sale administrators, conservation district personnel and others. Council discussion strongly supported the concept that educational programs should involve a variety of agencies and organizations to effectively reach the target audiences.

C. Pre-Sale Assistance

EQC endorsed a proposal to require landowners or operators to notify the Department of State Lands prior to conducting forest practices. The Council also endorsed having DSL provide pre-sale assistance by reviewing BMPs and watershed concerns with landowners and operators who submit notifications.

Council discussion indicated that these steps are intended to ensure that DSL knows about pending logging operations and has an opportunity to provide timely BMP information that can be incorporated into sale planning. Council members noted that legislation may be necessary to institute this requirement if existing law (the required notification for slash disposal purposes) is not appropriate. Council discussion also indicated that DSL, as the lead agency, would be in the best position to determine the number of sales that could receive assistance, based on funding and staffing considerations. Methods of setting priority sites for assistance and procedures for interagency involvement were not fully discussed.

D. Oversight of BMP Application

In considering options for state oversight of private logging operations, the Council did not endorse a forest practices act that would establish mandatory regulation of management practices. The Council also debated and rejected a proposal calling for the Water Quality Bureau to adopt rules setting forth forestry best management practices. Discussion associated with this latter proposal indicated that the Water Quality Bureau should refer to the statewide BMPs adopted by forestry/watershed professionals for determining whether management practices are "reasonable" within the meaning of the Montana Water Quality Act.

The Council adopted a motion to authorize the Department of State Lands or an interagency group (with DSL as the lead agency) to monitor private forestry operations and to work cooperatively with sale administrators to promote voluntary use of BMPs to conserve watershed values.

E. Technical Issues

The Council endorsed efforts to make progress on a range of technical issues, including:

* refining BMPs for streamside management zones and high-hazard sites through an interagency group, including landowners;

* defining measurable standards for determining when beneficial uses are being impaired by sediment;

* addressing cumulative watershed effects; and

* monitoring forest water quality.

F. Follow-Up

The Council endorsed two measures to provide formal oversight of the state forest practices/watershed program. The first measure directed the formation of an interagency group to conduct and report on a series of timber sale audits during the summer of 1990. The second measure directed agencies to report to the EQC and to the 1991 Legislature on the status of various program elements (including education, pre-sale assistance, oversight of BMP application and effectiveness, and technical issues) and to develop recommendations.

G. Completion of HJR 49 Recommendations

EQC Chairman Senator Mike Halligan scheduled a meeting of the Environmental Quality Council during the second week of January 1989 to complete work on the HJR 49 recommendations. During this meeting, the Council is expected to address outstanding issues related to the allocation of funds and personnel to state agencies, interagency coordination, and any statutory changes that may be necessary to implement EQC recommendations. A legislative package on House Joint Resolution 49 may be developed by the Environmental Quality Council at this meeting.

X. LITERATURE CITED

ASIWPCA. 1985. America's clean water: the states' nonpoint source assessment. Association of State and Interstate Water Pollution Control Administrators.

California. 1986. California's forest practice act: a summary. California Dept. of Forestry.

Chapman, D.W. and K.P. McLeod. 1987. Development of criteria for fine sediment in the Northern Rockies ecoregion. Battelle Columbus Lab. EPA contract No. 68-01-6986.

DFWP. 1988. Survey of effects of logging practices on selected western Montana streams. Montana Dept. of Fish, Wildlife and Parks. July 1988.

EPA. 1987. Nonpoint source controls and water quality standards. Memorandum from L.J. Jensen to regional water management directors. Environmental Protection Agency, Washingon, DC. Aug. 19, 1987.

Frissell, S.S. 1987. Recommendations of the SAF task force on forest practices and water quality. Montana Society of American Foresters. August 4, 1988.

Hansen, P.L. 1988. Conflict in the riparian zone: the effects and challenges of agricultural use. Western Wildlands, Summer 1988, pp 12-16.

Henly, R.K. 1988. Fifteen years of experience with state forest practice laws: their origins, structure, evolution, and outcomes. Presented at Montana Soc. of Am. Foresters annual meeting, Feb. 1988.

Henly, R.K and P.V. Ellefson. 1986. State forest practice regulation in the U.S.: administration, cost and accomplishment. Univ. of Minn. Ag. Exp. Stn. Bullentin AD-SB-3011.

Henly, R.K., P.V. Ellefson, and R.J. Moulton. 1988. State regulation of private forest practices: what accomplishments at what costs? Western Wildlands, Winter 1988, pp 23-28.

Idaho. 1988a. Forest practices water quality management plan. Idaho Dept. of Health and Welfare. Jan. 1988. 134 pp.

Idaho. 1988b. Draft sediment criteria. Idaho Dept. of Health and Welfare. Boise, ID. September 1988.

Idaho. 1985. Silvicultural nonpoint source task force: final report. Idaho Dept. of Health and Welfare. 58 pp.

Jackson, D.H. 1988. Private forestry assistance in Montana: a program evaluation for FY 1984. Report to Montana Dept. of State Lands. March 1988. 33 pp.

Megahan, W.F. 1982. Channel sediment storage behind obstructions in forested drainage basins draining the granitic bedrock of the Idaho batholith. In: Swanson, F.J. et al; eds. Sediment budgets and routing in forested drainage basins. Gen. Tech. Rep. PNW-141, USDA Forest Service, Pacific NW For. and Range Exp. Stn., Portland, OR. pp 114-121.

MWQB. 1988a. State of Montana nonpoint source assessment report 1988. Montana Water Quality Bureau, Dept. of Health and Env. Sci. 120 pp.

MWQB. 1988b. State of Montana nonpoint source management plan 1988. Montana Water Quality Bureau, Dept. of Health and Env. Sci. 104 pp.

MWQB. 1986. Montana water quality 305(b) report, 1986. Montana Water Quality Bureau, Dept. of Health and Env. Sci. 198 pp.

MWQB. 1979. Statewide water quality management plan: recommendations of the statewide 208 water quality management planning project. Montana Water Quality Bureau, Dept. of Health and Env. Sci. 54 pp.

NCASI. 1988. Procedures for assessing the effectiveness of best management practices in protecting water and stream quality associated with managed forests. Nat. Council of the Paper Industry for Air and Stream Improvement. Tech. Bull 538. January 1988. 23 pp.

NRRC, 1987. Timber/fish/wildlife: a report for the Northwest Renewable Resources Center. Vol. 1, No. 1. Northwest Renewable Resources Center, Seattle, WA. Summer 1987. 8 pp.

Pfankuch, D.J. 1978. Stream reach inventory and channel stability evaluation: a watershed management procedure. USDA Forest Service, Northern Region. 26 pp.

Pilcher, S. 1987. Letter to Ron Prichard, Supervisor, Beaverhead National Forest. Montana Water Quality Bureau, Dept. of Health and Env. Sciences. Feb. 6, 1987.

Rasmussen, R. and D. Culwell. 1978. Evaluation of water quality problems and management needs associated with non-USFS silvicultural practices in the Montana statewide 208 area: final draft. Montana DHES Water Quality Bureau. 249 pp.

Riparian Habitat Technical Committee. 1985. Forest riparian habitat study: phase 1 report. Washington For. Practices Board. Olympia, WA. April 1985.

Solomon, R.M. and P.E. Avers. 1987. A water quality monitoring framework to satisfy legal requirements. Sympos. on monitoring, modeling and mediating water quality. Am. Water Res. Assn. May 1987. pp. 231-241.

USFS, 1984. Watershed policy and program review: summary report. U.S. Forest Service Northern Region. Missoula, MT. 22 pp.

Wann, D. 1987. Timber and tourists: Idaho confronts logging issues. EPA Journal. Dec. 1987. pp 20-22.

WDNR. 1987. Proposed forest practices rules and regulations, draft environmental impact statement. Washington Dept. of Natural Resources. May 1987. 143 pp.

Weaver, T. M. and J.J. Fraley. 1988. Coal Creek fisheries monitoring study No. VI and forest-wide fisheries monitoring 1987. Montana Dept. of Fish, Wildlife and Parks. Feb. 1988. 29 pp.

Wheeler, R.H. 1978. A forest service assessment of water pollution problems on the nationals forests in Montana with emphasis on silviculture and related activities, logging and roads. USDA Forest Service, Northern Reg. Missoula, MT. November 1978.

APPENDICES

House JOINT RESOLUTION NO. 49

INTRODUCED BY Rules

BY REQUEST OF THE HOUSE NATURAL RESOURCES COMMITTEE

A JOINT RESOLUTION OF THE SENATE AND THE HOUSE OF REPRESENTATIVES OF THE STATE OF MONTANA REQUESTING THAT THE ENVIRONMENTAL QUALITY COUNCIL CONDUCT AN INTERIM STUDY ON THE RELATIONSHIP BETWEEN FOREST MANAGEMENT AND WATERSHED EFFECTS AND ON THE USE OF BEST MANAGEMENT PRACTICES FOR FORESTRY PRACTICES IN MONTANA; AND REQUIRING A REPORT OF THE FINDINGS OF THE STUDY TO THE 51ST LEGISLATURE.

WHEREAS, the forest products industry is a mainstay of the Montana economy; and

WHEREAS, the forest watersheds of Montana provide an irreplaceable supply of clean water for domestic use, agriculture, recreation, and industry; and

WHEREAS, the harvest of timber may affect the quality and quantity of water from forest watersheds; and

WHEREAS, there is a need to assess available information on the relationship between timber harvesting and watershed effects in Montana to reach informed judgments about the management relationship of these crucial natural resources; and

WHEREAS, the timber industry has demonstrated a working

commitment to best management practices through efforts such as the Cumulative Watershed Effects Cooperative administered by the Department of State Lands, the tree farm program conducted by private forest landowners, and utilization of soil and streambed conservation techniques developed by local conservation districts; and

WHEREAS, use of best management practices may offer a range of benefits in relation to water quality, sustained-yield timber harvest, long-term employment opportunities, and resource conservation; and

WHEREAS, recent initiatives in Washington and Idaho have shown innovative ways to reach a consensus among interest groups on how to attain timber and watershed objectives while meeting the needs of forest landowners, timber operators, and citizens relying on forest watersheds; and

WHEREAS, it is desirable to draw together relevant information to assess whether administrative or legislative direction is necessary to further the use of best management practices for forestry in Montana.

NOW, THEREFORE, BE IT RESOLVED BY THE SENATE AND THE HOUSE OF REPRESENTATIVES OF THE STATE OF MONTANA:

That the Environmental Quality Council be assigned to study:

INTRODUCED BILL
HJR-49

APPENDIX A.

(1) how current forest management practices are affecting watersheds in Montana;

(2) the range of management practices that have proven effective in conserving watersheds while maintaining the economic viability of timber harvest operations;

(3) the existing administrative framework, including regulatory and voluntary efforts, promoting the use of best management practices in Montana and other states; and

(4) if areas for potential improvement are indicated, the actions that would be most conducive to achieving both watershed and timber goals.

BE IT FURTHER RESOLVED, that the Council work closely throughout the study with persons and organizations with technical expertise in timber harvest techniques and effects.

BE IT FURTHER RESOLVED, that the Council report the findings of the study to the 51st Legislature and, if necessary, draft legislation to implement its recommendations.

-End-

APPENDIX B.

ENVIRONMENTAL QUALITY COUNCIL

House Joint Resolution 49 -- Forest Practices and Watershed Effects
September 14-15, 1987
Agenda

SEPTEMBER 14, 1987

Forestry Center, University of Montana Lubrecht Forest, Greenough
[Entrance on Highway 200, approximately 30 miles east of Missoula]

9:30 a.m. WELCOME AND INTRODUCTION

SENATOR MIKE HALLIGAN
EQC Chairman

9:45 FOREST PRACTICES AND WATERSHED EFFECTS:
AN OVERVIEW OF CONCEPTS

Moderator: TOM ROY, EQC, Missoula

Presenters:

JIM BENTLEY, Logging Manager
Champion International, Missoula

DON POTTS, Associate Professor of Watershed Management
University of Montana School of Forestry

BILL SCHULTZ, Hydrologist
Division of Forestry, Department of State Lands

10:50 Break -- Coffee and Doughnuts

11:00 STATE, FEDERAL AND LOCAL REGULATION OF
FOREST MANAGEMENT ACTIVITIES IN MONTANA

Moderator: SENATOR TOM BECK, EQC, Deer Lodge

Presenters:

GARY BROWN, State Forester
Division of Forestry, Department of State Lands

MIKE GOGGIN, Forester
Region 1, U.S. Forest Service

WALLY CONGDON, Supervisor
Missoula Conservation District

LOREN BAHLS, Water Quality Management Supervisor
Water Quality Bureau, Dept. of Health and Env. Sciences

ROUNDTABLE: Best Management Practices

Moderator: REP. HAL HARPER, EQC, Helena

Participants: G. BROWN, M. GOGGIN, W. CONGDON, L. BAHLS

KEN KNUDSON, Biological Consultant

KEITH OLSON, Montana Logging Association

BRAD SHEPARD, Department of Fish, Wildlife and Parks

MARK SIMONICH, Stoltze Land and Lumber

DON WOOD, Wood Forestry Services

12:30 p.m. Lunch Break and Announcements

(Note: Food will not be available at Lubrecht Forest. Persons are invited to bring their own sack lunches; coffee will be provided.)

TED GIESEY -- Society of American Foresters
BOB PFISTER -- Montana Riparian Association

1:30 FROM CONFLICT TO CONSENSUS:
WASHINGTON STATE'S TIMBER/FISH/WILDLIFE AGREEMENT

Moderator: EVERETT SHUEY, EQC, Butte

Presenters:

FRANK GAFFNEY, Project Director
Northwest Renewable Resources Center, Seattle

BRUCE BECKETT, Silviculturist
Plum Creek, Seattle

ROUNDTABLE: T/F/W: Impressions and Implications for Montana

Moderator: TOM FRANCE, EQC, Missoula

Participants: FRANK GAFFNEY, BRUCE BECKETT

BOB LAMLEY, Champion International

PETER NIELSEN, Clark Fork Coalition

CRAIG HESS, Flathead Basin Commission

3:20 Break

3:30 MONTANA PERSPECTIVES

Moderator: REP. BOB GILBERT, EQC Vice Chairman, Sidney

Presenters:

DON ALLEN, Montana Wood Products Association

PETER NIELSEN, Clark Fork Coalition

RICHARD REID, Society of American Foresters

MIKE ATWOOD, East Side Forest Practices Committee

JIM SCHMITT, Greater Yellowstone Coalition

KEITH OLSON, Montana Logging Association

JIM JENSEN, Montana Environmental Information Center

PAT KEARNEY, Timberland Owner

JOE GUTKOSKI, Montana Wildlife Federation

WALLY CONGDON, Montana Assn. of Conservation Districts

SCOTT HESS, Plum Creek Timber

HOWIE MCDOWELL, Montana Tree Farm Program

[Representative, Trout Unlimited]

STEVE LAURSEN, Montana Cooperative Extension Service

DENNIS HEMMER, Department of State Lands

4:45 PUBLIC COMMENT

Moderator: TAD DALE, EQC, Dillon

5:10 WRAP UP

SENATOR MIKE HALLIGAN, EQC Chairman

5:15 EQC BUSINESS

5:30 ADJOURN

SEPTEMBER 15, 1987

Tour of Lolo Creek Watershed. Tour departs at 8:30 a.m. sharp from the junction of U.S. Highways 12 and 93 in Lolo, and concludes at about 4:30 p.m. Members of the public must arrange their own transportation and food (sack lunches are recommended). EQC will help coordinate rides to reduce the number of vehicles; please contact EQC if you have an underfilled vehicle.

APPENDIX C.

DRAFT STUDY PLAN
FOR
HOUSE JOINT RESOLUTION 49

Prepared by Hugh Zackheim
Environmental Quality Council
October 2, 1987

INTRODUCTION

House Joint Resolution 49, enacted by the 1987 Montana Legislature, directs the Environmental Quality Council to conduct an interim study on the relationship between forest management and watershed effects in Montana. Specifically, the resolution assigns EQC to study:

> "(1) how current forest management practices are affecting watersheds in Montana;
> (2) the range of management practices that have proven effective in conserving watersheds while maintaining the economic viability of timber harvest operations;
> (3) the existing administrative framework, including regulatory and voluntary efforts, promoting the use of best management practices in Montana and other states; and
> (4) if areas for potential improvement are indicated, the actions that would be most conducive to achieving both watershed and timber goals."

The resolution further directs EQC to work closely with persons and organizations having technical expertise in timber harvest techniques and effects. A study report and recommendations are to be submitted to the 1989 Legislature.

This draft study plan indicates a proposed course of research designed to generate the information and analysis necessary to meet the goals of HJR 49. The study plan addresses the four numbered items (quoted above from HJR 49) as specific tasks to be achieved.

The draft study plan specifies the elements of each task, the organizational structure that will be employed in the study, the timetable for completing specific steps, and the product.

Your comments and suggestions are invited on this draft study plan. Please send written comments to EQC, Capitol Station, Helena, MT 59620; or you may call Hugh Zackheim at 444-3742. Comments received on or before October 20 will be presented to Council members for their consideration.

Members of the Environmental Quality Council will formally consider the draft plan at their next meeting at the Bozeman Public Library on the afternoon of Thursday, October 22. There will be an opportunity for public comment at that time.

TASK 1: Determine how current forest management practices are affecting Montana watersheds.

Elements of Task 1

A. Develop data base on the effects of forest practices on Montana watersheds by reviewing available written information, surveying land managers, interviewing other knowledgeable resource personnel and, if feasible, conducting site visits to determine the watershed effects of a random sample of state, private and federal timber sales and of identified problem areas

Available written information:
- 208 (nonpoint source pollution) reports
- WQB 305(b) data base
- WQB inspection/enforcement records
- DFWP forest practices project
- Missoula CD site review
- USFS reports
- Reports or monitoring information from DSL, USGS, industry, others

Resource personnel:
- WQB, DFWP, DSL, USFS, CDs, SCS, BLM, SAF, USGS, EPA, University system, extension forester, tribes, citizen groups, industry representatives

B. Define the criteria to be used to judge watershed effects

Legal concepts:
- Compliance with water quality standards
- Effects on beneficial uses
- Relation to non-degradation policy and rules

Site-review concepts (examples):
- Erosion hazard
- Channel morphology impacts
- Embeddedness, turbidity and other sediment measures

C. Synthesize, analyze and report the findings

Organizational Structure for Task 1

A. Watershed Effects Working Group

Membership: A representative and balanced group of resource personnel, appointed by EQC

Objective: To assemble and review information pertinent to an assessment of the effects of forest management on Montana watersheds

Specific Tasks: Assist EQC in the development of the watershed effects data base

Define the watershed effects criteria

Develop field survey procedures and conduct field reviews (a subcommittee may be advisable for this)

Assist EQC in synthesizing the data and analyzing causes of problems

Review the draft/final reports on watershed effects

B. EQC Staff Role

Organize meetings of WEWG and provide support services

Synthesize information and comments into draft and final reports

Product of Task 1

Final Report on the Effects of Forest Practices on Montana Watersheds

Timetable for Task 1

10/87	Solicit participants for Watershed Effects Working Group
11/87	Watershed Effects Working Group (WEWG) appointed by EQC; Initial WEWG meeting to review data availability, to determine data acquisition approach and methods, and to request data from appropriate sources. Also, WEWG to begin to define watershed effects criteria (subcommittee may be advisable)
12/87	Data received and compiled by EQC staff. WEWG continues to work on defining watershed effects criteria and developing field survey procedures
1/88	WEWG meeting to review data, establish watershed effects criteria and provide direction to EQC staff for draft report
2/88	Report on written data and criteria begun by EQC staff
3/88	WEWG meeting held to review report progress and to finalize methods and logistics of site visits and/or random survey of timber sales
4-5/88	Conduct site visits
6/88	Data compiled; WEWG meeting to review and assess data; draft report developed and sent out for comment
7/88	Comments incorporated and final report issued

TASK 2: Study the range of management practices that have proven effective in conserving forest watersheds while maintaining the economic viability of timber harvest operations.

Elements of Task 2

A. Review and compare lists of best management practices (BMP's) that have been developed by various agencies and organizations to protect water quality from the potential adverse impacts of forest management operations; highlight key similarities and differences

B. Assess the relationship of specific BMP's to water quality

C. Assess the economic implications of specific BMP's to timber operators

D. Assess the tradeoffs between prescriptive BMP's and flexible BMP's in relation to the operational conditions of timber harvesting activities

E. Assess the effectiveness of BMP application under both regulatory and nonregulatory approaches in various jurisdictions

Organizational Structure for Task 2

A. BMP Technical Committee

Membership: A representative and balanced group having technical familiarity with BMP's; appointed by EQC

Objectives: To reach a consensus list of BMP's that will achieve watershed goals without unreasonably infringing upon timber harvest needs or economics

To highlight unresolved policy issues relating to management by BMP's

Specific Tasks: Identify and compile BMP lists that are pertinent to the Montana situation

Identify consensus BMP's

Work to resolve any differences of opinion on the cost or effectiveness of specific BMP's

Discuss and evaluate issues pertinent to the assessments called for under "Elements of the Task" (see above)

Seek to develop consensus resolutions to issues

B. EQC Staff Role

Organize meetings of BMP Technical Committee and provide support services

Prepare summary report (as described below)

Product of Task 2

A report that includes a list of consensus BMP's; a review of the pros and cons of other BMP's; an assessment of the issue of prescriptive BMP's versus flexible BMP's; and an assessment of BMP application under regulatory and nonregulatory approaches

Timetable for Task 2

10/87	Solicitation for participants in BMP Technical Committee
11/87	BMPTC appointed by EQC; initial meeting to review information sources and to discuss committee operation and goals. Development by EQC staff of BMP worksheet that allows respondents to indicate views or preferences on specific management practices
12/87	Distribution of BMP lists, related materials, and BMP worksheet to BMPTC members
1/88	Completion of worksheets by BMPTC and compilation of results by EQC staff
2/88	BMPTC meeting to review worksheet results, formalize agreement on consensus BMP's, and define BMP issues in need of additional attention (because of economic or water quality considerations)
3/88	Development of further information on non-consensus BMP's
4/88	BMPTC meeting to attempt to resolve outstanding differences;
5/88	BMP report preparation begun by EQC staff
6/88	BMPTC meets to discuss information developed by Watershed Effects Working Group on effectiveness of BMP implementation and implementation strategies
8/88	Best Management Practices report prepared by EQC staff

TASK 3: Study the administrative framework promoting best management practices for forestry in Montana and other states

TASK 4: Develop recommendations, if necessary, for actions that will best achieve both timber and watershed goals

Elements of Tasks 3 and 4

A. Establish specific timber and watershed policy goals for Montana (in relation to the HJR 49 study issues)

B. Compile information on federal, state, local and private programs to promote use of BMP's and assess the effectiveness of these programs; as part of this effort, utilize information developed under Tasks 1 and 2

C. Determine the program or policy needs to achieve the goals established under "A"; develop appropriate implementation options

D. Select policy recommendations

Organizational Structure for the Task

A. Environmental Quality Council

EQC members will oversee and direct the study, and will give operational and policy guidance as necessary. The EQC will appoint a representative and balanced panel of study participants to a Timber/Watershed Policy Forum (TWPF) that will review information and help develop policy options. EQC members will participate in TWPF meetings; EQC members are ultimately responsible for policy recommendations to be forwarded to the 51st Legislature and the Administration.

B. Timber/Watershed Policy Forum

The TWPF will consist of participants appointed by EQC and representative of various perspectives on forest management/ watershed issues. TWPF will meet periodically to review study progress of the study and to discuss issues. TWPF will attempt to reach consensus solutions and will report to EQC.

C. EQC Staff

EQC staff will work under the direction of the Council to generate, distribute, and analyze information, to provide for appropriate public participation, and to develop policy options. EQC staff will provide support services to the TWPF.

D. General public, interest groups, governmental agencies, and others

The various "publics" will play an integral part in the HJR 49 study by providing information, analysis, and opinions throughout the process. There will numerous opportunities for public participation in person at EQC meetings, at committee meetings, and through responses to reports or draft documents, in addition to the formal committee structures established in the separate study tasks. The deliberations of the Council will be made in full consideration of this public participation.

Product

HJR 49 Report from the Environmental Quality Council to the 51st Legislature, including policy recommendations and rationale

Timetable

1/88	EQC appoints members of Timber/Watershed Policy Forum (TWPF). TWPF convenes to review study status and discuss its mission and approach
3/88-5/88	TWPF meets as appropriate to consider information developed by EQC staff (on state, federal and local programs promoting BMPs), by BMP Technical Committee, and by Watershed Effects Working Group
6/88-8/88	TWPF meets as appropriate to review and analyze information and to formulate policy options for EQC
9/88	Draft report and policy options prepared by EQC staff; TWPF convenes to review report; public comment period (30-day minimum) conducted
10/88	Final report issued, including recommendations by EQC

ABBREVIATIONS

BLM -- Bureau of Land Management

BMP -- Best management practices

CD -- Conservation district

DFWP -- Department of Fish, Wildlife and Parks

DSL -- Department of State Lands (Division of Forestry)

EQC -- Environmental Quality Council

SAF -- Society of American Foresters

SCS -- Soil Conservation Service

TWPF -- Timber/Watershed Policy Forum

USFS -- U.S. Forest Service

USGS -- U.S. Geological Survey

WEWG -- Watershed Effects Working Group

WQB -- Water Quality Bureau

APPENDIX D.

HOUSE JOINT RESOLUTION 49 -- TECHNICAL COMMITTEE MEMBERSHIP
Environmental Quality Council 1987-88

I. WATERSHED EFFECTS WORKING GROUP
Chairman: Representative Bob Gilbert

Name	Professional Field	Affiliation
Bob Anderson	Nat. Resource Mgmt.	Am. Forestry Association
Larry Brown	Hydrology	Water Quality Bureau
Vito Ciliberti	Forest Hydrology	Bureau of Land Management
Tony Colter	Timber Management	Lousiana-Pacific Corp.
Dana Field	Plant Ecology	MT Audubon Council
Dean Graham	Wildlife Biologist	Wildlife Society
Scott Hess	Forest Hydrology	Plum Creek Timber
Hal Hunter	Forestry	Soil Conservation Service
Bob Lamley	Timber Management	Champion International
Bill Magnuson	Forestry	Soc. of Amer. Foresters
Kennon McClintock	Forestry	Lincoln Cons. District
Keith Olson	Logging Operations	MT Logging Association
Glenn Phillips	Water Quality	Fish, Wildlife & Parks
Don Potts	Forest Hydrology	UM School of Forestry
Noel Rosetta	Soil Conservation	MT Env. Information Ctr.
Jim Schmitt	Soil Science	MSU Earth Sciences
Bill Schultz	Forest Hydrology	Dept. of State Lands
Bob Schrenk	Forestry	U.S. Forest Service
Mark Simonich	Forestry	Stoltze Land & Lumber
Jack Stanford	Limnology	UM Flathead Lake Bio. Stn.
P. Bengeyfield (Alt.)	Hydrology	U.S. Forest Service
Dick Reid (Alt.)	Forestry	Soc. of Amer. Foresters
Bill Putnam (Alt.)	Hydrology	U.S. Forest Service

II. BEST MANAGEMENT PRACTICES TECHNICAL COMMITTEE
Chairman: Representative Hal Harper

Name	Professional Field	Affiliation
Don Alley	Fisheries	Trout Unlimited
Sherm Anderson	Logging Operations	MT Logging Association
Mike Atwood	Timber Management	Brand S Lumber
Larry Brown	Hydrology	Water Quality Bureau
Bill Gwynn	Logging/For. Mgmt.	Ind. Logger/Landowner
Pam Hackley	Soil Science	MT Env. Information Ctr.
Lorin Hearst	Forester	Soc. of Amer. Foresters
Scott Hess	Forest Hydrology	Plum Creek Timber
Marcia Hogan	Forestry	U.S. Forest Service
Russ Hudson	Timber Management	Champion International
David Jackson	Forest Economics	UM School of Forestry
Ken Knudson	Aquatic Ecology	Clark Fork Coalition
Reed Kuennen	Wildlife Biology	Wildlife Society
Joel Marshik	Engineer	U.S. Forest Service
Jack Perkins	Rancher/CD Supervisor	Powell Co. Cons. District
Bill Schultz	Forest Hydrology	Dept. of State Lands
Brad Shepard	Fisheries Biology	Fish, Wildlife & Parks
Kit Sutherland	Soil Conservation	Soil Conservation Service
Don Wood	Forestry	Private Forest Consltnt.
Andy Lukes (Alt.)	Forestry	Champion International
Tim Sullivan (Alt.)	Hydrology	U.S. Forest Service
Mike Thompson (Alt.)	Wildlife Biology	Wildlife Society

APPENDIX E.

A QUESTIONNAIRE ON WATERSHED PROBLEMS AND SOLUTIONS FOR FOREST MANAGEMENT IN MONTANA

Environmental Quality Council
Room 432, State Capitol, Helena, MT 59620
June 15, 1988

PLEASE REFER TO THE INSTRUCTION SHEET TO ANSWER THE FOLLOWING QUESTIONS AND TO FIND DEFINITIONS OF UNDERLINED TERMS.

PART I. WATERSHED DAMAGE CAUSED BY FOREST PRACTICES

Complete items #1 through #7 for each site where forest practices during the past five years have caused watershed damage. Report only one site or timber sale per sheet. You should reproduce this sheet to report on additional sites or sales.

Timber Sale or Site Name _____
Location (w/township, range, section, if known) _____
_____
Land Ownership _____
Tributary Name & Major Drainage Basin _____
Distance from Site to Stream Channel _____
Soil Type Geology _____
Approximate Date of Activity _____

1. Give a brief description of the site and associated damage.

_____
_____
_____
_____
_____

2. What is the nature and severity of damage to the watershed?

___ Water quality -- sediment
___ Water quality -- other (Specify: _____)
___ Streambed condition -- sediment
___ Streambed condition -- debris
___ Riparian zone/wetland vegetation or soils
___ Bank stability
___ Stream channel structure

[0-no effect 1-minor 2-moderate 3-severe ?-do not know]

3. Have there been any adverse effects on aquatic resources or beneficial uses?

___ Not enough information to determine if adverse effects have occurred
___ No adverse effects have occurred
___ The following adverse effects have occurred (use code numbers to indicate severity):

___ Fisheries ___ Aquatic insects ___ Drinking water
___ Irrigated agriculture ___ Recreational use
___ Other (Specify _____)

[1-minor 2-moderate 3-severe]

4 On the following list circle the code numbers of the forest management practices that have contributed to watershed damage at this site Also, place an asterisk next to the code number of the practice(s) most responsible for the damage

R1	inadequate erosion control during road pioneering
R2	inadequate erosion control from other road construction activities (including poorly stabilized cut/fill slopes or improper disposition of waste materials)
R3	inadequate road drainage facilities (culverts ditches, drain dips, etc.)
R4	inadequate maintenance of road surface or drainage facilities
R5	poorly designed/installed stream crossing structures
R6	road located too near stream
R7	road located on steep slope or other high erosion hazard site
R8	inadequate or untimely revegetation of exposed soils
H1	excessive logging disturbance in riparian zone or on streambanks
H2	equipment operation during wet-season conditions
H3	equipment operation in marshy or wet sites
H4	inadequate control of erosion from skidding practices
H5	equipment operation or crossings in stream channel
H6	improper management of logging slash or debris
S1	excessive soil disturbance during site-preparation for reforestation
O	other (specify any other practices causing watershed damage _____)

5a Are any other land uses contributing significantly to the problem at this site?

___ Yes ___ No

If yes, check the contributing land use(s):

___ Grazing ___ Mining ___ Off-road Vehicles
___ Agriculture ___ Highways
___ Other (Specify: _____)

5b Are natural sources of sediment (i.e., erosion not associated with human activities or land uses) contributing significantly?

___ Yes ___ No

5c If you have indicated a contribution from other land uses or from natural sources for questions #5a or #5b, what is the relative contribution of forest management activities to the identified problem?

___ Minor ___ Moderate ___ Major

6. Are there indications of forest practices causing watershed damage within the drainage by virtue of cumulative watershed effects?

___ Yes ___ No If yes, explain on a separate sheet.

7. What is the source of your information about this site?

_____

When did you inspect the site? _____

Were the forest practices completed at the time of the inspection?

___Yes ___ No

Please list any available monitoring data, reports photographs or other information or analysis on this site:

_____

PART II. MODEL TIMBER HARVEST OPERATIONS

Complete items #8 through #11 for sites where careful application of best management practices or the use of innovative harvesting techniques has prevented watershed damage in drainages with high erosion hazards or sensitive environmental values.

Timber Sale or Site Name _____

Location (w/township, range, section, if known) _____

_____

Land Ownership _____

Tributary Name & Major Drainage Basin _____

Distance from Site to Stream Channel _____

Soil Type/Geology _____

Approximate Date of Activity _____

8. Characterize any high erosion hazards at the site. _____

_____

_____

9. Characterize any sensitive environmental values within the watershed. _____

_____

_____

10. Specify the management practices employed that prevented erosion and/or damage to sensitive environmental values:

_____

_____

_____

_____

11. Can the practices employed at this site be successfully used at other sites with similar erosion hazards or sensitive environmental values?

___ Yes ___ No

Briefly explain. _____

_____

_____

_____

NAME _____

ADDRESS _____

TELEPHONE _____

PROFESSIONAL POSITION _____

AFFILIATION _____

RETURN ALL QUESTIONNAIRES TO EQC NO LATER THAN AUGUST 31, 1988.

Questions? Call the Environmental Quality Council at 444-3742.

INSTRUCTION SHEET FOR EQC QUESTIONNAIRE ON WATERSHED PROBLEMS AND SOLUTIONS FOR FOREST MANAGEMENT IN MONTANA

GENERAL INFORMATION

House Joint Resolution 49, enacted by the 1987 Montana Legislature, directs the Environmental Quality Council to determine how forest management is affecting Montana watersheds and to evaluate the effectiveness of specific management practices in conserving watersheds. This questionnaire is one aspect of the information-gathering effort, and solicits the assistance of hydrologists, foresters, loggers, biologists, and other professionals having field experience with forest practices. The questionnaire has been reviewed and approved for distribution by a technical committee consisting of representatives of state and federal agencies, the timber industry, private landowners, water quality managers, and citizen organizations.

Part I of the questionnaire requests respondents to identify Montana watersheds damaged by forest practices. The questions require you to exercise professional judgment to relate specific impacts and to evaluate causes. **Please complete a separate Part I for every site or timber sale that you are knowledgeable about where watershed damage has occurred.**

Part II of the questionnaire focuses on forest management practices that have been conducted in sensitive environmental areas, without damaging watershed resources. Such sites demonstrate the effective use of best management practices, and indicate the potential for "safe" operations in locations that might otherwise be considered off-limits. **Please complete a separate Part II for every site or timber sale that you are knowledgeable about where forest practices have been conducted under highly sensitive conditions without causing watershed damage.**

On each questionnaire you may report one site for Part I and one site for Part II. **You should reproduce the questionnaire to report on additional sites for either Part I or Part II or both.**

Questionnaires should be returned to EQC no later than **August 31, 1988**. The results will be included in EQC's report to the 1989 Legislature, along with a range of additional information developed through on-site audits of management practices, working group and technical committee meetings, interviews, and other research conducted under the direction of the Environmental Quality Council in accordance with HJR 49.

DEFINITIONS

For the purposes of this questionnaire, the following definitions apply:

Cumulative watershed effects means changes in water quality, streamflow, channel structure, or aquatic habitat caused by the interaction of natural ecosystem processes with multiple forest practice operations. Cumulative effects of forest practices may be incremental (for example, a gradual increase in water yield with the harvesting of each additional unit) or may occur suddenly (as in stream siltation from a landslide triggered by a combination of activities).

Forest practices means those activities undertaken in the process of accessing, removing, and regenerating timber. Forest practices include road construction, location, design and maintenance; harvesting and skidding operations; site preparation for reforestation; and related activities.

High erosion hazards means the presence of erodible soils (e g, granitics, certain glacial tills, lacustrine sediments), unstable or very steep slopes, or sites with sensitive near-stream conditions (including steep or erodible banks unstable stream channels, or flood-prone areas).

Sensitive environmental values means drinking water sources, riparian habitat, or high-quality fishery habitat that supports significant resident fish populations or important seasonal spawning runs.

Stream channel means a perennial, intermittent, or ephemeral water course.

Watershed damage means adverse effects on the water quality, biological community, physical structure, or hydrologic processes of a permanent or intermittent stream, a lake, or a wetland.

GUIDE TO THE QUESTIONS IN PART I

1. Characterize the site and the manner in which forest practices have damaged the watershed. If applicable, indicate the approximate length of stream damaged (or the size of a damaged lake or wetland). Note that the following questions request more specific information on causes and effects.

2. Question #2 asks you to indicate the adverse physical changes in a watershed that have been caused by forest practices. For each of the seven response options, write down the appropriate code (0,1,2,3 or ?). For the purposes of this question, the following effects *when caused by forest management activities* should be noted:

3. Question #3 asks you to assess whether aquatic resources or water uses have been damaged by forest practices. If you indicate that damage has occurred, write down the appropriate code (1,2, or 3) to indicate the severity of damage for each item affected.

4. Question #4 lists a variety of forest management practices that may be subject to inadequate control or improper implementation. Circle the codes of the specific management practices that have caused or contributed to the watershed impacts cited in your responses to questions #1 through #3. Also, place an asterisk by the practice(s) most responsible for the damage. Provide additional narrative information at the bottom of this page if you wish to amplify your response.

5. This question is intended to sort out the impacts of forest management activities from natural phenomena and other land uses. Note that question #5c requests you to indicate the relative contribution of forest management activities as a source of the observed watershed damage.

6. Indicate whether cumulative watershed effects (as defined on the reverse side of this instruction sheet) appear to be occurring in the drainage. Use a separate sheet to detail these effects (e.g., increased water yield, sediment production, changes in stream channel structure) and briefly relate the evidence for your conclusion that such cumulative watershed effects are occurring and are being caused by forest practices. Indicate any other land uses that are contributing to the problem.

7. Indicate whether your information on the site is based on personal observation, visual reports from other field observers, monitoring data, or other sources. Provide the approximate date of any site inspection and indicate whether the forest practices were completed. Use the lines provided to identify any existing written information related to the site.

GUIDE TO THE QUESTIONS IN PART II

Questions #8 through #11 request you to indicate sites with sensitive environmental values or high erosion hazards where logging and associated roadbuilding have been conducted without adverse watershed impacts.

Please provide brief narrative answers to characterize the site, to indicate the particular management practices employed and the management goals accomplished, and to assess whether these techniques can be used successfully at other sensitive sites.

RETURN COMPLETED QUESTIONNAIRES NO LATER THAN AUGUST 31, 1988, TO

Environmental Quality Council
Room 432, State Capitol
Helena, MT 59620
(406) 444-3742

APPENDIX F.

1988 TIMBER SALE AUDITS

Environmental Quality Council

House Joint Resolution 49

SOUTHWEST TEAM

Date	Audit No.	Sale Name	Ownership	Location
July 26	1.	[Private]	NIPF	N. of Avon
	2.	[Private]	NIPF	E. of Deer Lodge
July 27	3.	[Private]	NIPF	Jefferson City
	4.	Two Brothers	USFS	N. of Basin
August 23	5.	Pine Creek	IPF	N. of Bozeman
	6.	Twin Sisters	USFS	E. of Canyon Ferry
August 24	7.	Gambler Creek	IPF	N. of Drummond
	8.	Black Bear Cr.	IPF	N. of Drummond
Sept. 1	9.	Wickiup Cr.	IPF	Ennis (Jack Creek)
	10.	Hammond Cr.	IPF	Ennis (Jack Creek)
	11.	Butte Meadows	USFS	S. of Bozeman
Sept. 2	12.	[Private]	NIPF	S. of Livingston
	13.	[Private]	NIPF	E. of Livingston

WEST CENTRAL TEAM

Date	Audit No.	Sale Name	Ownership	Location
July 15	1.	Placid Lake	DSL	S. of Seeley Lake
	2.	Nevershine	BLM	N. of Drummond
August 8	3.	[Private]	NIPF	Paradise
	4.	Cedar Branch	USFS	W. of St. Regis
August 9	5.	[Private]	NIPF	W. of Florence
	6.	Corley Gulch	DSL	E. of Victor
August 15	7.	Wall Canyon	IPF	Alberton (Fish Cr.)
	8.	Thompson Cr.	IPF	Alberton (Fish Cr.)
August 16	9.	Bear Creek	IPF	Lolo Creek drainage
	10.	Coop-Cab Pulp	USFS	Lolo Creek drainage
August 22	11.	Blue Boles	IPF	SW. of Seeley Lake
	12.	N. Grouse Road	IPF	SW. of Seeley Lake

NORTHWEST TEAM

Date	Audit No.	Sale Name	Ownership	Location
July 26	1.	[Private]	NIPF	E. of Whitefish
	2.	Upper Woods Lake	DSL	Stillwater State For.
July 27	3.	Basin Porcupine	USFS	W. of Eureka
	4.	Pinkham Creek	DSL	S. of Eureka
August 11	5.	Little Bull	IPF	N. of Libby
	6.	Baitmania	USFS	N. of Libby
	7.	Jackson Creek	IPF	N. of Libby
August 12	8.	Deep Creek	IPF	S. of Libby
	9.	Trail Creek #9	IPF	S. of Libby
August 23	10.	Emmons Creek	USFS	W. of Somers
	11.	GP 10	IPF	Hubbart Reservoir
August 24	12.	Lone Lake	DSL	N. of Marion
	13.	Boiling Springs	IPF	Thompson Lakes

TIMBER SALE AUDIT TEAMS

SOUTHWEST TEAM

Joel Marshik	Engineer	Deerlodge Nat. For.
Glenn Phillips	Fisheries Biol.	Fish, Wildlife & Parks
Mike Atwood	Forester	Brand S Lumber
Larry Brown	Hydrologist	Water Quality Bureau
Pam Hackley	Soil Scientist	Private Consultant/MEIC

WEST CENTRAL TEAM

Vito Ciliberti	Hydrologist	BLM
Bob Black	Forester	Plum Creek
Gordon Sanders	Forester	Champion International
Bill Schultz	Hydrologist	DSL Division of Forestry
Don Wood	Forester	Private Consultant

NORTHWEST TEAM

Bill Magnuson	Forester	Soc. of American Foresters
Kennon McClintock	Forester/Soils	WI Forest Products
Bill Putnam	Hydrologist	USFS -- Region 1
Mark Simonich	Forester	Stoltze Land & Lumber
Jim Vashro	Fisheries Biol.	Fish, Wildlife & Parks

Alternates: Dennis Davaz (Brand S) for Mike Atwood
Tom Weaver (DFWP) for Jim Vashro

APPENDIX G.

Best Management Practices Technical Committee
Environmental Quality Council -- House Joint Resolution 49
September 15, 1988

A SUMMARY OF BEST MANAGEMENT PRACTICES

FOR STREAMSIDE ZONES

FROM VARIOUS JURISDICTIONS

MONTANA

See "Streamside Management Zone Guidelines and Prescriptions"
Montana Department of State Lands

See "Best Management Practices for Forestry in Montana"
Cumulative Watershed Effects Cooperative

OREGON

Source: Forest Practice Rules for Eastern Oregon; effective 8/1/87

Definitions

Stream Classification
Class I waters: "significant for" specified beneficial uses
Class II " : "definite channel or bed"
Class II Special Protection: Class II w/cooling effect on Class I
State forester maintains a stream classification map

Riparian Zone & Width
Riparian area: the ground area along a Class I water where the vegetation and microclimate are influenced by perennial or intermittent water, associated high water tables, and soils that exhibit some wetness characteristics.

Riparian management area (RMA): area in which special management practices are required for the protection of water quality, aquatic habitat, and wildlife habitat. Includes riparian areas and riparian areas of influence.

Width: RMA shall average 3 times stream width, but not less than 25' or more than 100'; for lakes and significant wetlands, RMA averages 25 - 100', depending on waterbody size.

Riparian area of influence (RAI): transition area between riparian area and upland vegetation. Forms outer edge of the riparian management area, and provides trees for shade, woody debris recruitment and wildlife habitat.

Management Goals

In 629-24-446, OAR, "Protection of the Waters of the State": [This section] "is designed to recognize the public's interest in growing and harvesting timber in the riparian management area while protecting the soil, water quality, aquatic habitat, and wildlife habitat resources found therein. During and after harvesting operations, waterways and riparian area vegetation shall be protected to assure the protection of water quality, soil, wildlife habitat, and aquatic habitat values.

"The operator shall provide for shade, wildlife habitat, soil stabilization, and water filtering effects of forest vegetation in riparian management areas adjacent to Class I waters" [by] . . .

Operational Restrictions

Roading, Felling and Yarding

Avoid tractor skidding through any stream. When streams must be crossed, provide adequate temporary structures to carry stream flow. Remove all temporary crossings immediately after use and, where applicable, water bar road ends.

Avoid cable yarding through any Class I water; yarding must be done with [full suspension] over stream and riparian area and without unnecessary disturbance of riparian area of influence.

Avoid RMA for road location where practical alternatives exist; no fire trails; approved temporary skid trails only.

Prior approval required for: machine activity, skidding or yarding in or through Class I; landings; parallel roads; temporary skid trail crossings.

Timber should be removed carefully so as to maintain the shading, water filtering, soil stabilizing, and aquatic and wildlife habitat values of the riparian management area.

Operator shall not operate crawler tractors or wheeled skidders within the riparian area except by prior approval from the state forester where necessary for stream crossings.

Cable yarding across Class II waters shall be done in a way which minimizes disturbance to the channel and the streambank vegetation.

Fell, buck, limb trees away from Class I, and remove if debris enters Class I waters.

Fell trees in Class II to prevent damage to aquatic and riparian habitat, and remove slash from Class II.

Soil and Vegetation Disturbance

Leave stabilization strips of undergrowth vegetation along all Class II waters in widths sufficient to prevent washing of sediment into Class I waters downstream.

No burning in a riparian area along Class I water; when burning in a RAI, protext aquatic and wildlife habitat, such as downed logs and snags.

Leave Trees

Maintain an average of 75% of the original shade over the aquatic areas along Class I; retain 50% of the original tree canopy in the riparian area along Class I.

Leave 75% of original shade along Class IISP.

U.S. FOREST SERVICE

Sources: Soil and Water Conservation Practices Handbook
Forest Service Manual

Definitions

Riparian areas: Areas with distinctive resource values and characteristics that are comprised of an aquatic ecosystem and adjacent upland areas that have direct relationships with the aquatic system (riparian ecosystems). This includes wetlands and all areas within a horizontal distance of approximately 100 feet from the normal high water line of a perennial stream, or from the shoreline of a standing body of water. The riparian area is not a zone of exclusion, but an area of closely managed activity. Riparian areas act as an effective filter and absorptive zone for sediment; maintain shade; protect aquatic and terrestrial riparian habitats; protect channel and streambanks; and promote floodplain stability.

Streamside management zone: A designated zone that consists of the stream and an adjacent area of varying width where management practices that might affect water quality, fish, or other aquatic resources are modified. The SMZ is not a zone of exclusion , but a zone of closely managed activity. It is a zone which acts as an effective filter and absorptive zone for sediment; maintains shade; protects aquatic and terrestrial riparian habitats; protects channel and streambanks; and promotes floodplain stability. The SMZ may be wider than the riparian area.

Wetlands: [defined]

Management Goals

(Riparian Areas) To minimize the adverse effects on riparian areas with prescriptions that manage nearby logging and related land disturbance activities.

(Stream Channel Protection) To protect the natural flow of streams; to provide unobstructed passage of stormflows; to reduce sediment and other pollutants from entering streams; and to restore the natural course of any stream as soon as practicable if the stream is diverted as a result of timber management activities.

Operational Restrictions

As a preventive measure, roads, skid trails, landings and other timber harvesting facilities will be kept out of these areas, when feasible, or at a prescribed distance from streams and wetlands. Factors such as stream class, channel stability, sideslope steepness, slope stability, resources dependent on these areas, and standards, guidelines and direction from forest plans are considered in determining the management of activities and width of riparian areas. Fisheries habitat conditions and its estimated response to the proposed timber sale are also evaluated.

Environmental analysis will provide for planning of harvest to insure long-term health and revegetation of the riparian areas, while meeting shading, debris recruitment, and other management objectives.

Project debris shall be removed from streamcourse (within 48 hours) and damage to streamcourse shall be repaired.

Give special attention to land and vegetation for approximately 100 feet from the edges of all perennial streams, lakes and other water bodies. The distance shall correspond to at least the recognizable area dominated by the riparian vegetation.

Wheeled or track-laying equipment shall not operate within 50 feet slope distance of the high-water mark of streamcourses designated for protection, except as agreed to by Sale Administrator.

When ground skidding systems are employed, logs will be endlined out of streamside and riparian areas. Equipment is permitted to enter streamside areas only as agreed.

Water bars and other erosion control structures will be located to prevent water and sediment from being channeled into streamcourses and to dissipate concentrated flows.

Material from temporary road and skid trail stream crossings is removed and streambanks restored to acceptable condition.

Logs shall be fully suspended above the ground when crossing streamcourses designated for protection.

WASHINGTON

Sources: Washington Forest Practices Rules and Regulations, 1988; Draft Environmental Impact Statement, Proposed Forest Practices Rules and Regulations, May 1987 (see pp 80-101); FEIS; Draft Supplemental EIS; FSEIS.

Definitions

Stream Classification

Type 1 Water: inventoried shorelines
Type 2: "high use and are important from a water quality standpoint for" various uses; generally, 20'+ width, 4% grade
Type 3: "moderate to slight use and are moderately important from a water quality standpoint for" various uses; generally, 5' width, 12% grade, 0.3 cfs low flow, less than 10' falls
Type 4: perennial or intermittent, with significance based on their influence on downstream water qual.; greater than 2' channel width
Type 5: all other waters in natural water courses, including streams with or without a well-defined channel, areas of perennial or intermittent seepage, ponds, and natural sinks. Drainage ways having short periods of spring runoff are considered to be Type 5.

Riparian Zone and Width

Riparian management zone means a specified area along Type 1, 2 and 3 waters where specific measures are taken to protect water quality and fish and wildlife habitat.

Zone extends from ordinary high-water mark to the line where vegetation changes from wetland to upland plant community, but shall not be less than 25' nor more than 100' in Western WA (maximum width determined by chart, based on stream size). Expand zone where necessary to include swamps, bogs, marshes, ponds, adjacent to stream. In Eastern WA, the zone width is based on the adjacent harvest type (regeneration or partial), and ranges from 30' to a 50' average.

Management Goals

To protect water quality and fish and wildlife habitat (222-16-010). Also, in SEIS (p. 23) "The riparian management zone requirements specified in this section are designed to provide protection for water quality and fisheries and wildlife habitat through ensuring present and future supplies of large organic debris for streams, snags, canopy cover, and a multi-storied diverse forest adjacent to Type 1, 2 and 3 Waters." -- policy statement for FP rules.

Operational Restrictions

Roading, Felling and Yarding

No felling into 1, 2, and 3 waters (222-30-050) except where unavoidable and with hydraulic permit; fall trees to the lead; no bucking or limbing in (1,2,3) water; type 4 water less restrictive for felling and bucking -- reasonable care to avoid felling trees into RMZ and to avoid damage to residual trees.

No timber shall be cable yarded in or across 1,2,3 waters except where logs will not damage bed, banks or RMZ (222-30-060), and where hydraulic approval obtained. Any logs embedded in Class 1 - 4 shall not be removed without approval.

Where timber is yarded from or across a RMZ, reasonable care shall be taken to minimize damage to the vegetation providing shade to the stream and to minimize disturbance to understory vegetation, stumps and root systems. Where practical and consistent with good safety practices, logs shall be yarded in the direction in which they lie and away from 1-3 waters until clear of the RMZ.

When yarding within the RMZ, reasonable care shall be taken to minimize soil disturbance and to prevent logs from rolling into the water or RMZ.

Tractor and wheeled skidders shall not be used in Class 1-3, except with hydraulic approval; skidding across any flowing 4 water shall be minimized and when done, temporary stream crossings shall be used if necessary to maintain streambed integrity; whenever skidding in or across any water, move logs at right angles (222-30-070).

Logging will be permitted within the RMZ; however, any use of tractors, wheeled skidders or other yarding machines must be approved. Minimize skidding routes through RMZ and minimize damage to leave trees and vegetation.

In riparian zones, slash disposal shall be by hand unless otherwise approved.

Soil and Vegetation Disturbance (222-30-030)

Avoid disturbing brush; avoid disturbing stumps and root systems and any logs embedded in the bank; leave high stumps where necessary to prevent felled and bucked timber from entering the water; leave trees which display large root systems embedded in the bank.

Leave trees

"Leave tree" requirements range from 25 to 100 trees per 1000 linear foot of stream in Western WA, and from 75 to 135 trees per acre (4" or larger dbh) in Eastern WA. Other size considerations apply -- see rules for details. Leave trees may be required along Type 4 water where necessary to protect public resources.

Additional shade requirements (222-30-040) for temperature sensitive streams (50 - 75% of shade); can be waived if windthrow is potential problem and under other circumstances and conditions.

IDAHO

Source: Idaho FPA Rules, January 1988

Definitions

Stream Classification

Stream means a natural water course of perceptible extent with definite beds and banks which confines and conducts continuously or intermittently flowing water. Definite beds are defined as having a sandy or rocky bottom which results from the scouring action of water flow.

Class I streams are used for domestic water supply or are important for the spawning, rearing or migration of fish.

Class II streams are usually headwater streams or minor drainages that are used by only a few, if any, fish for spawning or rearing. Their principal value lies in their influence on water quality or quantity downstream in Class I streams.

Riparian Zone and Width

Class I Stream Protection Zone means the area encompassed by slope distance of 75 feet on each side of the ordinary highwater marks.

Class II Stream Protection Zone means (at minimum) the area encompassed within the ordinary highwater marks. [But see Figure 2 indicates a 5' SPZ beyond the ordinary highwater mark, and Rule 3.g.iv. that calls for undisturbed soils at least 5 wide along Class II.]

Management Goals

During and after forest practice operations, stream beds and streamside vegetation shall be protected to leave them in the most natural condition as possible to maintain water quality and aquatic habitat. (Stream Protection -- Rule 3, (g))

Operational Restrictions

Roading, Felling and Yarding

Tracked or wheel skidding in or through streams shall not be permitted. When streams must be crossed, adequate temporary structures to carry stream flow shall be installed. Cross the stream at right angles to its channel if all possible. Remove all temporary crossings immediately after use and where applicable, water bar the ends of the skid trails. (Also, Stream Channel Protection Act -- Title 42, chapter 38, Idaho Code)

When cable yarding is necessary, across or inside the SPZ it shall be done in such a manner as to minimize stream bank vegetation and channel disturbance.

Plan transportation networks to minimize road construction within SPZ. Design to leave or reestablish areas of vegetation between roads and streams. (Rule 4.b.)

Plan culvert installations on Class I streams to provide for fish passage. (R4,b,vi) On abandoned roads, the department may require the removal of bridges and culverts except where the owner elects to maintain the drainage structures as needed.

Soil and Vegetation Disturbance

Provide the shading, soil stabilization and water filtering effects of vegetation along Class I streams by one or more of the following:

-- leave hardwood trees, shrubs, grasses, and rocks wherever they afford shade over a stream or maintain the integrity of the soil near a stream;

-- develop an acceptable harvest plan to prevent stream temperature increase and maintain wildlife cover if you can't leave 75% original shade;

-- carefully log to not destroy shading and filtering effects;

-- variance procedure to reestablish streamside vegetation if shade can't be left;

-- provide soil stabilization and water filtering effects along Class II streams by leaving undisturbed soils in widths sufficient to prevent washing of sediment into Class I streams. In no case shall this width be less than 5 feet slope distance above the ordinary high water mark on each side of the stream.

When conducting operations along lakes, bogs, swamps, wet meadows, springs, seeps or other sources where the presence of water is indicated, protect soil and vegetation from disturbance which would cause adverse effects on water quality, quantity and wildlife and aquatic habitat. Consider leaving buffer strips.

Leave Trees

No specific requirements other than shade reference above.

CALIFORNIA

Source: California Forest Practice Rules, Northern Forest District

Definitions

Stream Classification

Class I through IV streams, based on beneficial uses, as follows:
Class I: domestic water and/or fisheries
Class II: fisheries and/or other aquatic life
Class III: no aquatic life, but watercourse is capable of sediment transport to Class I or II waters
Class IV: manmade watercourse

Streamside Zone and Width

Stream and lake protection zone (SLPZ) is 150, 100 or 50 feet from water transition line, depending on "estimated erosion potential" (extremely high -- 150'; high -- 100'; or moderate or low -- 50'). Estimated erosion potential is derived from a formula that uses slope and soil type to derive a hazard rating for a particular site. Additional direction for determining zone width is provided, depending on slope from streambank to next topographic (slope) break; zones range from 50 - 200 feet for Class I and from 50 - 150' for Class II. Protection zones must be identified on the ground before harvest.

Protection zone width for class III and IV waters is determined through on-site inspection; protection must be sufficient to prevent degradation of the downstream beneficial uses of water.

Management Goals

The purpose of [the watercourse and lake protection rules] is to insure the protection of the beneficial uses that are derived from the physical form, water quality, and biological characteristics of watercourses and lakes. The intent is to restore, enhance and maintain the productivity of timberlands while providing equal consideration for the beneficial uses of water. A further intent is to clarify and assign responsibility, to recognize potential impacts of timber operations on the beneficial uses of water, and to adopt feasible measures to prevent water pollution related to timber harvesting.

Operational Restrictions

Roading, Felling and Yarding

Heavy equipment shall not be used in falling, yarding or hauling unless use is approved and specific areas of use are flagged.

Stream courses and other wet areas shall not be used for landings, roads or skid trails without approval.

Trees shall be felled away from the watercourse.

Alternative prescriptions may be approved on a site-specific basis if equal watershed protection is provided.

Soil and Vegetation Disturbance

Exposed mineral soil exceeding 800 square feet within a Class I or II protection zone must be stabilized by mulching, seeding, riprapping, etc., prior to Oct. 15 or within 10 days to prevent significant movement of soil into waters.

Vegetation (other than commercial species) covering or bordering meadows or wet areas shall be retained. Soil in these areas shall be protected to the maximum extent possible.

See also "Leave Trees" below

Leave Trees

Different requirements are established for residual vegetation within the stream protection zone based on the different stream classes and slope classes. For Class I, at least 50% of the overstory canopy shading the watercourse and 50% of the understory vegetation shall be left standing and well distributed within the zone. This is intended "to protect water temperature and act as a sediment filter strip". For Class II, at least 50% of the overstory canopy shading the watercourse and/or 50% of the understory vegetation may be required to be left standing within the protection zone.

APPENDIX H.

REVISED DRAFT -- FOR REVIEW BY BMP TECHNICAL COMMITTEE
ENVIRONMENTAL QUALITY COUNCIL -- HJR 49
OCTOBER 13, 1988

BEST MANAGEMENT PRACTICES FOR FORESTRY IN MONTANA

DEFINITIONS

1. "Hazardous substance" means a material which by its nature is toxic, dangerous to handle or dispose of, or a potential environmental contaminant, and includes petroleum products, pesticides, herbicides, chemicals, and biological wastes.

2. "Stream" means a natural water course of perceptible extent with definite beds and banks which confines and conducts continuously or intermittently flowing water. Definite beds are defined as having a sandy or rocky bottom which results from the scouring action of water flow.

3. "Streamside Management Zone (SMZ)" means the stream itself and an adjacent area of varying width where management practices that might affect water quality, fish, or other aquatic resources are modified. The streamside management zone is not a zone of exclusion but a zone of closely managed activity. The SMZ acts as an effective filter and absorptive zone for sediment; maintains shade; conserves aquatic and terrestrial riparian habitats; protects the stream channel and banks; and promotes floodplain stability.

   The SMZ encompasses a strip at least 25-feet wide on each side of a stream, measured from the ordinary high-water mark. The width of the SMZ extends beyond the 25-foot minimum to include wetlands along the stream bottom and to provide additional protection in areas of steep slopes or erosive soils. [For example, an SMZ width of 65 feet has been recommended for a 20% slope on stable soils; a 200' SMZ has been recommended for 40% slopes on erosive soils.] OR [For example, an SMZ width of up to 200' has been recommended for sites with highly erosive soils and continuous steep slopes.] Often, there is a change in slope steepness between the steep-sided stream corridor and a more level upland bench; this slope break can make an appropriate boundary for the SMZ.

4. "Wetlands" means 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

MANAGEMENT PRACTICES

I. 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 where practical, unless use of such roads would cause or aggravate an erosion problem.

2. Review available information and consult with agencies as necessary to help identify erodible soils and unstable areas, and to locate appropriate road surface materials.

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.

4. Locate roads on stable geology, including well-drained soils and rock formations that tend to dip into the slope. Avoid slumps and slide-prone areas characterized by steep slopes, highly weathered bedrock, clay beds, concave slopes, hummocky topography, and rock layers that dip parallel to the slope. Avoid wet areas, including moisture-laden or unstable toe slopes, swamps, wet meadows, and natural drainage channels.

5. Locate roads a safe distance from streams when roads are running parallel to stream channels. Provide an adequate streamside management zone (SMZ) in order to catch sediment and prevent its entry into the stream (see definition of "streamside management zone" for guidance on width).

6. Minimize the number of stream crossings and choose stable stream crossing sites.

7. Locate roads to provide access to suitable (relatively flat and well-drained) log landing areas in order to reduce soil disturbance.

B. Design

1. Properly designed roads and drainage facilities are the best way to prevent potential water quality problems from road construction.

2. Design roads to the minimum standard necessary to accommodate anticipated use and equipment. The need for higher standard roads can be alleviated through better road-use management.

3. Design roads to balance cuts and fills or use full bench construction (no fill slope) where stable fill construction is not possible.

4. Design roads for minimal disruption of drainage patterns. Vary road grades to reduce concentrated flow in road drainage ditches and culverts and to reduce erosion on cut and fill slopes and road surface.

5. Design stream-crossing structures for adequate passage of fish (if present), minimum impact on water quality, and at a minimum, the 25-year frequency runoff (see Section III for other stream-crossing BMPs).

C. Drainage from Road Surface

1. Provide adequate drainage from the surface of all permanent and temporary roads by using outsloped or crowned roads, drain dips, or insloped roads with ditches and crossdrains. Space road drainage facilities so that peak drainage flow on the road surface or in ditches will not exceed the handling capacity of the individual drainage facilities.

   a. Outsloped roads provide an excellent means of dispersing water in a low-energy flow from the road surface. Outsloped roads are appropriate when fill slopes are stable, drainage will not flow directly into stream channels, and transportation safety considerations can be met.

   b. For insloped roads, plan ditch gradients steep enough, generally greater than 2%, but less than 8%, to prevent sediment deposition and ditch erosion. The higher gradients may be suitable for more stable soils; use the lower gradients for less stable soils.

   c. Properly constructed drain dips can be an economical method of channeling surface flow off the road surface. Construct drain dips deep enough into the subgrade that traffic will not obliterate them.

2. Skew ditch relief culverts 20 to 30 degrees toward the inflow from the ditch to provide better inlet

efficiency. Protect the upstream end of cross-drain culverts from plugging by sediment and debris.

3. Where possible, install ditch relief culverts at the gradient of the original ground slope; otherwise armor outlet with rock or anchor downspouts to carry water safely across the fill slope.

4. Provide energy dissipators (rock piles, logs, etc.) where necessary at the downstream end of ditch relief culverts to reduce the erosion energy of the emerging water. Crossdrains, culverts, water bars, dips, and other drainage structures should not discharge onto erodible soils or fill slopes without outfall protection.

5. Prevent downslope movement of sediment by using sediment catch basins, drop inlets, changes in road grade, headwalls, or recessed cut slopes.

6. Route road drainage through SMZ, filtration fields, or other sediment settling structures or systems of adequate design. Install road drainage facilities above stream crossings so water will not discharge directly into a stream.

D. Construction (see also Section III on stream crossings)

1. Keep slope stabilization, erosion and sediment control work as current as possible with road construction. Complete or stabilize road sections within the same operating season as construction is started, rather than leave major road sections in an unstable condition over a winter season. Install drainage structures concurrent with construction of new roads and always prior to fall or spring runoff.

2. Stabilize erodible, exposed soils by seeding, compacting, riprapping, benching, mulching, or other suitable means prior to fall or spring runoff.

3. At the toe of potentially erodible fill slopes, particularly near stream channels, pile slash in a row parallel to the road to trap sediment. When done concurrently with road construction, this practice can effectively control sediment movement and can provide an economical way of disposing of roadway slash. Limit the height, width and length of these "slash filter windrows" so they do not impede wildlife movement.

4. Minimize earth-moving activities when soils appear excessively wet. Do not disturb roadside vegetation more than necessary to maintain slope stability and to serve traffic needs.

5. Construct cut and fill slopes at stable angles.

6. Avoid incorporating potentially unstable woody debris in the fill portion of the road prism. Where possible, leave existing rooted trees or shrubs at the toe of the fill slope to stabilize the slope.

7. Consider road surfacing if necessary to minimize erosion.

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.

9. Minimize sediment production from borrow pits and gravel sources through proper location, development, and reclamation.

10. When using existing roads, reconstruct only to the extent necessary to provide for adequate drainage and safety; avoid disturbing stable road surfaces.

E. Maintenance

1. Grade road surfaces only as often as necessary to maintain a stable running surface and to retain the original surface drainage.

2. Keep erosion control measures functional through periodic inspection and maintenance, including cleaning dips and crossdrains, repairing ditches, marking culvert inlets to aid in location, and clearing debris from culverts.

3. Avoid cutting the toe of cut slopes when grading roads or pulling ditches.

4. When plowing snow for winter timber harvest, provide breaks in snow berm to allow road drainage.

5. Haul all excess material removed by maintenance operations to safe disposal sites and stabilize these sites to prevent erosion. Avoid side-casting material where it will enter a stream or be available to erode directly into a stream.

6. Avoid the use of roads during wet periods and the spring breakup period if such use would likely damage road drainage facilities and result in increased sedimentation.

7. Upon completion of seasonal operations, the road surface should be crowned, outsloped, insloped, or water-barred. Remove berms from the outside edge where runoff is channeled.

8. Leave abandoned roads in a condition that provides adequate drainage without further maintenance. Close these roads to traffic; reseed and/or scarify; and, if necessary, recontour and provide water bars or drain dips.

II. Timber Harvesting, Streamside Management and Site Preparation

A. Harvest Design

1. Plan timber harvest in consideration of your management objectives and the following:
   a. Soil characteristics and erosion hazard identification;
   b. Rainfall characteristics;
   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 potential cumulative effects of multiple timber management activities on water yield, sediment production, and beneficial water uses; and
   i. Wildlife habitat.

2. 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 will minimize road densities.

4. Design and locate skid trails and skidding operations to minimize soil disturbance. The use of 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 from skid trails.

6. Minimize the size and number of landings to that necessary for safe, economical operation. Avoid locating landings that would require skidding across drainage bottoms.

B. Streamside Management

1. Designate streamside management zones around perennial and intermittent streams to provide stream shading, soil stabilization, sediment- and water-filtering effects, and wildlife habitat. In establishing the SMZ, apply the definition and guidance for zone width provided on page 1. Consult with forestry professionals, soil and water conservation specialists, and/or biologists if assistance is needed in setting appropriate SMZ boundaries.

2. Consider the following practices when harvesting timber in the streamside management zone:

   a. Retain hardwood trees, sub-merchantable conifers, and shrubs in the SMZ to aid in maintaining stream temperatures within legal limits, to maintain bank stability, and to provide habitat for wildlife.

   b. Retain bank-edge trees which are key to channel stabilization and to future input of large woody debris (e.g., fallen logs and root wads) to the stream channel. In the proper locations, large woody debris in the stream channel helps to dissipate stream energy, stabilize banks, and form pools that trap sediment and provide essential fish habitat.

   c. When clearcutting up to the stream edge, consider the length of stream channel opened to the sun. Where possible, keep continuous openings under 600 feet of stream length.

This helps prevent increases in the water temperature and promotes wildlife habitat diversity.

d. Recognize that in some soil and drainage types, clearcutting can cause marked increases in the water table, cold-air ponding, and grass/shrub competition. All of these factors can inhibit conifer regeneration. To ensure conifer re-establishment, some mature trees may need to be left on site.

e. Maintain or provide sufficient ground cover to trap sediment. Hand-scalping and planting may be preferable to machine scarification or burning within the SMZ. Whole-tree or tree-length yarding can reduce the need for slash disposal in the SMZ.

f. Steep slopes containing material that could roll down-slope and fall into a stream during burning should receive special attention. Trees logged along streams can be high-stumped to help prevent this. A fuel-free zone can be necessary to maintain streamside vegetation if site preparation will involve burning on steep ground adjacent to the SMZ.

3. Minimize operation of wheeled or tracked equipment within the SMZ, and avoid equipment operation in wetlands, bogs, and wet meadows except when the ground is frozen (see Section IV on winter logging). Do not operate equipment on stream banks.

4. Use directional falling for harvest operations in the SMZ or wet areas. Avoid falling trees or leaving slash in streams or water bodies. Limb or top trees above the high-water mark.

5. Suspend the lead end of the log during skidding whenever possible, and use cables to end-line logs out of SMZs and wet areas when ground skidding systems are employed. Logs should be fully suspended when skyline skidding across a stream and immediately above streambanks. Ground skidding through any perennial stream requires a 310 permit (see Section III on stream crossings).

6. Avoid decking logs within the ordinary high-water mark of any stream.

C. Other Harvesting Activities

1. Tractor skid when compaction, displacement, and erosion will be minimized. Avoid tractor or wheeled skidding on unstable, wet, or easily compacted soils and on slopes that exceed 40% unless operations can be conducted without causing excessive erosion. Avoid skidding with the blade lowered.

2. For each landing, skid trail, or fire trail, provide and maintain a drainage system to control the dispersal of water and to prevent sediment from entering streams.

3. Install necessary water bars on tractor skid trails; appropriate spacing between bars is determined by the soil type and slope of the skid trail. Timely implementation is important.

4. When natural revegetation is inadequate to prevent accelerated erosion before the next growing season, apply seed or construct water bars on skid trails, landings and fire trails. A light ground cover of slash or mulch will help retard erosion.

D. Slash Treatment and Site Preparation

1. Rapid reforestation of harvested areas is encouraged to re-establish protective vegetation.

2. Use brush blades on dozers when piling slash. Avoid use of dozers with angle blades. Site preparation equipment producing irregular surfaces is preferred. Care should be taken to preserve the surface soil horizon.

3. Minimize or eliminate elongated exposure of soils up and down the slope during mechanical scarification.

4. Scarify the soil only to the extent necessary to meet the reforestation objective of the site. Low slash and small brush should be left to slow surface runoff, return soil nutrients, and provide shade for seedlings.

5. Carry out brush piling and scarification when soils are frozen or dry enough to minimize compaction and displacement.

6. Carry out scarification on steep slopes in a manner that minimizes erosion. Broadcast burning and/or herbicide application is a preferred means

for site preparation, especially on slopes greater than 40%.

7. Consider reclamation of landings and temporary roads on completion of use.

8. Remove all logging machinery debris to proper disposal site.

9. Limit water quality impacts of prescribed fire by constructing water bars in firelines; not placing slash in drainage channels; maintaining the streamside management zone; and avoiding intense fires unless needed to meet silvicultural goals.

III. Stream Crossings

A. Legal Considerations

1. Under the Natural Streambed and Land Preservation Act of 1975 (the "310 law"), any activity that would result in physical alteration or modification of a perennial stream, its bed or immediate banks must be approved in advance by the supervisors of the local conservation district. Permanent or temporary stream crossing structures, fords, riprapping or other bank stabilization measures, and culvert installations on perennial streams are some of the forestry-related projects subject to 310 permits.

2. Before beginning such a project, the operator must notify the conservation district of the location, description, and project plans. The evaluation generally includes on-site review, and the permitting process may take up to 60 days.

3. A short-term exemption from water quality standards may be required if construction activities will add sediment to surface water and thus violate water quality standards. Contact the Water Quality Bureau in Helena at 444-2406 for additional information.

4. Stream-crossing projects initiated by federal, state or local agencies are subject to approval under the "124 permit" process (administered by the Department of Fish, Wildlife and Parks), rather than the 310 permit.

B. Design Considerations (Note: 310 permit required)

1. Cross streams at right angles to the main channel

if practical. Adjust the road grade to reduce the concentration of water carried by drainage ditches to stream crossings. Direct drainage flows through an SMZ and away from the stream crossing site.

2. Avoid unimproved stream crossings. Where a culvert or bridge is not feasible, locate drive-throughs on a stable, rocky portion of the stream channel.

C. Installation of Stream Crossings (Note: 310 permit required)

1. Minimize stream channel disturbances and related sediment problems during construction of roads and installation of stream crossing structures. Do not place easily eroded material into live streams and remove any stockpiled material before rising water reaches it. Locate temporary construction bypass roads to have minimal disturbance on the stream course. Limit construction activity to specific times to protect beneficial uses of the watershed, such as fisheries and water quality.

2. When using culverts to cross small streams, install to conform to the natural stream bed and slope on all perennial streams and on intermittent streams that support fish or that provide seasonal fish passage or spawning sites. Place culverts slightly below normal stream grade to avoid culvert outfall barriers. Do not alter stream channel upstream from culvert, unless necessary to protect fill or to prevent culvert blockage.

3. Install culvert installations to prevent erosion of fill. Compact the fill material to prevent seepage and failure. Armor the inlet and/or outlet with rock or other suitable material where needed.

4. Consider dewatering stream crossing site during culvert installation.

5. Protect culverts from crushing due to traffic. Use 1 foot minimum cover for culverts 18 to 36 inches in diameter, and a cover of one-third diameter for larger culverts.

6. Use culverts with a minimum diameter of 15 inches for permanent stream crossings and crossdrains.

IV. Winter Logging

A. General

1. Consider snow-road construction and winter harvesting when logging sites characterized by wet meadows, high-water tables, sensitive riparian conditions or other potentially significant soil erosion and compaction hazards.

2. Conduct winter logging operations when the ground is frozen and snow cover is adequate (generally more than one foot), thus minimizing site disturbance. Be prepared to suspend operations if conditions change rapidly (e.g., a thawing chinook wind) and erosion hazard becomes high.

3. Consult with operators experienced in winter techniques if you have little prior experience.

B. Road Construction and Harvesting Considerations

1. For road systems across areas of poor foundation, consider hauling only during frozen periods. During cold weather, plow any snow cover off of the roadway to facilitate deep freezing of the road grade prior to hauling.

2. Before logging, mark existing culverts well and keep them clean and open. After logging, make sure that all culverts and ditches are clean, free of debris, and functional.

3. In unroaded, wet or sensitive sites, construct snow roads for single-entry harvests or for temporary roads. Use compacted snow for road bed.

4. Mark stream courses prior to snowfall so that even small streams are identifiable. Conduct activities in streamside zones so that ground disturbance is minimized. Use extra snow as the base for stream crossings and restore the crossing to near pre-road conditions (to prevent ice dams) following completion of snow road use. Do not use the stream channel for the roadway.

5. When the ground is snow-covered, skidding can be conducted on wet, unfrozen soil areas without damage to soil and water resources. Prior to felling, use tractors or skidders to compact the snow for skid road locations. Avoid steeper areas where frozen skid trails may be subject to erosion the next spring.

6. Return the following summer and build erosion barriers on any trails that are steep enough to erode.

7. Slash disposal and site preparation on wet, boggy sites may by done utilizing snow-free periods during the winter when these areas are frozen.

V. Hazardous Substances

A. General

1. Know and comply with regulations governing the storage, handling, application (including licensing of applicators), and disposal of pesticides, herbicides, containers, biological waste, petroleum products, dust abatement compounds, or other hazardous substances.

2. Do not transport, handle, store, load, apply, or dispose of any hazardous substance in such a manner as to pollute water supplies or waterways, or cause damage or injury to land, including humans, desirable plants and animals.

3. Do not store, mix, or rinse hazardous substances below the high-water mark or where hazardous substances might enter state waters.

4. Develop a contingency plan for hazardous substance spills, including cleanup procedures and notification of the state Water Quality Bureau.

Pesticides and Herbicides

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

2. To prevent the entry of hazardous substances into surface waters:

   a. Chemical treatments within the streamside management zone shall be by hand and shall be applied only to specific targets.

   b. Leave a 25-foot buffer along surface waters when chemicals are being applied through ground application with power equipment.

   c. For aerial application, leave at least a 50-foot buffer along live water and do not spray in the SMZ.

d. Always refer to chemical label instructions for additional guidance on use near water and required buffer zones.

3. To enhance effectiveness and prevent transport into streams, apply chemicals during appropriate weather conditions (generally calm and dry) and during the optimum time for control of the target pest or weed.

APPENDIX I. **DSL FOREST PRACTICE REVIEW WORKSHEET**

REVIEWER(S):_____

DATE:_____

SALE NAME:_____ SALE NO._____

LEGAL DESCRIPTION:_____

AREA:_____

UNIT:_____

STAGE OF OPERATION:

ROAD CONSTRUCTION_____

HARVEST_____

SLASH DISPOSAL_____

SITE PREP_____

OTHER_____

RATING GUIDE

APPLICATION

5 - OPERATION EXCEEDS REQUIREMENTS OF CONTRACTS/BMPs
4 - OPERATION MEETS REQUIREMENTS OF CONTRACTS/BMPs
3 - MINOR DEPARTURE FROM THE INTENT OF CONTRACT/BMPs
2 - MAJOR DEPARTURE FROM THE INTENT OF CONTRACT/BMPs
1 - GROSS NEGLECT OF CONTRACT/BMPs

EFFECTIVENESS

5 - IMPROVED PROTECTION OF SOIL AND WATER RESOURCES OVER PRE-PROJECT CONDITION
4 - ADEQUATE PROTECTION OF SOIL AND WATER RESOURCES
3 - MINOR AND/OR TEMPORARY DETRIMENTAL IMPACTS ON SOIL & WATER RESOURCES
2 - MAJOR DETRIMENTAL IMPACTS ON SOIL AND WATER RESOURCES, PRIMARILY SHORT TERM
1 - MAJOR DETRIMENTAL IMPACTS ON RESOURCES. DAMAGE EXTENSIVE. RECOVERY EXPECTED TO BE SLOW.

NR - NOT REVIEWED
NA - NOT APPLICABLE

HAZARD RATING:

Slope: 1: < 45% 2: 45%<>70% 3: > 70%
(*) Soils: 1: Low Haz. 2: Mod. Haz. 3: High Hazard

RECOMMENDED BEST MANAGEMENT PRACTICES	APPLICATION 1 2 3 4 5	EFFECTIVENESS 1 2 3 4 5	COMMENTS
ROADS PLANNING			
1.MINIMIZE NUMBER OF ROADS NECESSARY.			
2.PLAN ROADS TO THE APPROPRIATE STANDARD.			
3.LOCATIONS AVOID HIGH HAZARD SITES.			
4.ADEQUATE SMZ BETWEEN ROAD AND STREAM CHANNELS.			
5.PROPER PERMITS FOR STREAM CROSSINGS.			
6.AVOID LONG,SUSTAINED, STEEP ROAD GRADES.			
7.MINIMIZE NUMBER OF STREAM CROSSINGS.			

* GEOLOGIC TYPE:

Hard metamorphics, glacial tills, hard sediments & basalts	-1 Low Hazard
Soft metamorphics, soft sediments, pyroclastics & hard granitics	-2 Moderate Hazard
Glacial outwash, decomposed (low clay content) granitics	-3 High Hazard

RECOMMENDED BEST MANAGEMENT PRACTICES	APPLICATION 1 2 3 4 5	EFFECTIVENESS 1 2 3 4 5	COMMENTS
DRAINAGE			
1.PROVIDE ADEQUATE ROAD SURFACE DRAINAGE.			
2.DRAINAGE FEATURES INSTALLED IN A TIMELY MANNER.			
3.INSTALL DRAINAGE FEATURES TO ROUTE WATER THROUGH AN SMZ BEFORE ENTERING STREAM.			
4.STREAM CROSSING STRUCTURES PROPERLY INSTALLED, INCLUDING: ORIENTATION			
GRADE			
CAMBER			
COMPACTION			
COVER			
TIMING			
STABLE FILL			
ENERGY DISSIPATORS			
CONSTRUCTION			
1.CUT AND FILL SLOPES AT STABLE ANGLE.			
2.HALT OPERATIONS DURING WET PERIODS.			
3.EROSION AND SEDIMENT CONTROL WORK CURRENT WITH CONSTRUCTION.			
4.CLEAR VEGETATION BEFORE CONSTRUCTING FILL PORTION OF ROAD.			
5.OVERBURDEN PLACED IN LOCATION TO AVOID ENTERING STREAM.			
6.GRASS SEEDING COMPLETED IN A TIMELY MANNER			
MAINTENANCE			
1.GRADE ROAD SURFACES TO MAINTAIN SURFACE DRAINAGE AND RUNNING SURFACE.			
2.CULVERTS AND DITCHES KEPT FUNCTIONAL.			
3.AVOID CUTTING THE TOE OF STABLE CUT SLOPES WHEN GRADING ROADS.			
4.CLOSED ROADS LEFT IN CONDITION TO PROVIDE ADEQUATE DRAINAGE.			
5.RESTRICT USE OF ROADS DURING WET PERIODS AND SPRING BREAKUP.			

RECOMMENDED BEST MANAGEMENT PRACTICES	APPLICATION 1 2 3 4 5	EFFECTIVENESS 1 2 3 4 5	COMMENTS
TIMBER HARVEST			
1. ADEQUATE SMZ MAINTAINED.			
2. STREAMS FREE OF LOGGING DEBRIS.			
3. EQUIPMENT OPERATION IN WET MEADOWS AND BOGS AVOIDED.			
4. SKIDDING OPERATION MINIMIZES SOIL DISTURBANCE.			
5. SKIDDING OPERATION MINIMIZES SOIL COMPACTION.			
6. ADEQUATE WATER BARS INSTALLED ON SKID TRAILS AND FIRE LINE IN A TIMELY MANNER.			
7. SUITABLE LOCATION AND SIZE FOR LANDINGS.			
8. SUITABLE LOGGING SYSTEM FOR TOPOGRAPHY.			
9. ADEQUATE STORAGE AND DISPOSAL FOR FUEL, SHOP DEBRIS, AND WASTE OIL.			
10. SEASON OF USE RESTRICTIONS FOLLOWED.			
TREATMENT AND SITE PREPARATION			
1. BRUSH BLADES USED ON DOZERS.			
2. SCARIFICATION ONLY TO EXTENT NECESSARY TO MEET REFORESTATION OBJECTIVES.			
3. OPERATIONS DONE WHEN SOILS ARE DRY ENOUGH TO MINIMIZE COMPACTION AND DISPLACEMENT.			
4. DOZER OPERATIONS ON SUITABLE SLOPES ONLY.			
OTHER			
1. LUMEN SPOT.			

YARDING SYSTEM

Aerial	-1
Skyline	-2
Jammer & High Lead	-3
Rubber tire tractor	-4
Track tractor	-5

MONTANA CUMULATIVE WATERSHED EFFECTS COOPERATIVE

PROCESS TO ADDRESS WATERSHED EFFECTS IN MIXED OWNERSHIP DRAINAGES

July 1988

Introduction

This report is written to serve as documentation of the process developed by the Montana Cumulative Watershed Effects Cooperative for addressing watershed effects in mixed ownership watersheds.

The members of the Cooperative agreed to the following objective statement to served as the direction for the project:

> "The cooperators agree to develop a process to evaluate cumulative watershed effects which may identify the need to modify management practices in order to meet water quality objectives."

"Water quality objective" is defined as to comply with State regulations and insure the beneficial uses are not impaired.

The Cooperative established a technical committee to accomplish the objective statement. The technical committee includes a representative from each of the original Cooperative members.

The technical committee agreed that a methodology for determining cumulative impacts must include a means to verify impacts and establish a process for problem resolution. The methodology includes:

Phase 1 - Mechanism to identify existing or imminent cumulative watershed effects.

Phase 2 - Mechanism to verify cumulative watershed effects.

Phase 3 - Problem resolution process.

Background

The Montana Cumulative Watershed Effects Cooperative was formed in 1984 to promote timber sale planning to mitigate cumulative watershed impacts. Cooperative members include Plum Creek Timber Company, Champion International, U.S. Forest Service, Bureau of Land Management, Department of State Lands, Department of Health and Environmental Sciences,and the Department of Natural Resources and Conservation. The Montana Logging Association, Montana Association of Conservation Districts, and Montana Department of Fish, Wildlife , and Parks are associate members.

The Cooperative has been active in: 1) information exchange, and 2) development and promotion of Best Management Practices (BMPs). The information exchange covers mixed ownership watersheds in the vicinity of the Lolo, Kootenai, and

Flathead National Forests. The information exchange has progressed from a listing of proposed activities to a computer data base containing proposed and historic timber harvest data. The data base is available for use by cooperators to plan harvest and road activity to identify potential cumulative impacts. The Cooperative's BMPs have been adopted by the Montana Association of Conservation Districts and are applicable State-wide.

As the Cooperative evolved, it became apparent that it was essential for all members to agree to a methodology for determining when cumulative effects may occur and develop a process for resolving potential problems. All members agreed that with acceptance of such a methodology, forest operations may be rescheduled or modified within some drainages to meet water quality objectives.

PHASE 1: Identification

The technical committee discussed various watershed models, the shortcomings of watershed modeling, and the potential for misinterpretations of watershed condition based on model results. Watershed modeling procedures are not quantitative analysis tools. Models deal with average conditions and general relationships. Surpassing a threshold does not constitute a cumulative watershed effect, but raises a red flag and indicates the need for further review and verification. The committee recognized that the methodology chosen must be accessible and usable by all Cooperative members. To facilitate this, the methodology should be IBM P.C. compatible, input parameters should be readily available, and the product must be a usable management tool.

The committee selected the USFS WATBAL model which computes water and sediment yield increase from existing and proposed timber harvest, roads, and fire. The model is currently being used by the Forest Service and is appropriate for the precipitation/runoff regimes of Western Montana.

The committee recognizes the difficulties which could occur from operational constraints due to a WATBAL forecast. However, having the information available to managers at the earliest possible date will provide means to identify potential problem areas. Thus we will be "managing" the situation instead of reacting to accusations, complaints, or violations.

Input information requirements include general watershed characteristics, landtype acreage and coefficients, and past and future treatment inventories. The water yield portion is a computer version of the "ECA" water yield procedure. The sediment yield portion is a computerized version of the 1980 USFS publication "Guidelines For Predicting Sediment Yield." The model is fine-tuned using coefficients that reflect local conditions. To insure consistent use of WATBAL and to avoid duplication of effort, a directory of landtype maps and coefficients should be available to all participants. WATBAL is designed to run using land units as defined by the USFS Land System Inventory. Map units may have to be revised and coefficients developed for watersheds mapped with SCS Cooperative Soil Survey criteria.

Implementation of the WATBAL watershed model will not happen immediately. In some cases, development of the necessary input data and coefficients will

require considerable time. Modeling efforts should concentrate on potential problem watersheds.

Watershed Threshold Values

WATBAL produces percent water and sediment yield increase estimates. Model output is typically compared to recommended allowable upper limit (threshold) values. Exact threshold limits are difficult to verify. Lack of professional consensus exists concerning at what level thresholds should be set to protect beneficial uses and avoid cumulative watershed effects.

The technical committee recommends that each cooperator set their own thresholds rather than prescribing specific threshold limits for all. It is likely that each cooperator may prescribe a different threshold for the same drainage as some landowners will likely accept a higher risk than others. Model results should be shared with all affected cooperators.

When a cooperator feels his prescribed threshold has been reached, it is that cooperator's right and privilege to bring that information to the attention of the other cooperators for discussion and verification.

While the use of the WATBAL model is endorsed, any evidence of existing or imminent cumulative effects should be brought to the attention of appropriate Cooperative members. Evidence may include other models, water quality data, fisheries data, or other observations.

PHASE 2: Problem Verification

Verification of existing, suspected, or imminent cumulative effects is extremely difficult. This problem is complicated by differing opinions on what cumulative effects are, as well as differences in the level of risks landowners are willing to take. Verification that modeling results are reasonable is dependent upon professional judgement and interpretation, field measurements, and recognition of the model limitations. As noted earlier, modeling is capable only of raising a "red flag," and cannot be accepted as an absolute indicator. Therefore, it is important to consider a process for verifying the presence or absence of cumulative effects in a given drainage.

As noted in Phase 1, each Cooperator has the option of raising concerns about a given drainage whenever that Cooperator believes threshold values have been or will be reached. It then becomes the responsibility of that cooperator to verify the problem and convince other affected landowners that the concerns are legitimate. This effort may include some or all of the following:

a. Management History Review - An examination of the management history of a drainage, including the extent and type of past harvests and road construction, mitigation measures applied, and the degree of hydrologic recovery achieved may provide insights into the potential for cumulative effects.

b. Water Quality/Flow Data - Actual water monitoring data, where available, may be helpful for verifying cumulative effects. This data must

be presented ia an understandable format, and other cooperators have the right to critically review the monitoring procedures, raw data, and conclusions reached.

c. Stream Condition Measurements - A variety of stream condition measurements and evaluation procedures have been developed for forest streams. These include channel condition inventories, fish habitat surveys, channel substrate measurements, and numerous others. Each of these procedures have strengths and weaknesses, but properly applied, they can be very helpful for documenting watershed impacts.

d. General Field Observations - Field trips to observe general conditions within a drainage are often helpful for understanding watershed effects.

It must be recognized that cooperators will not always agree on the significance or even the existence of cumulative effects. It is also important to note that there may be several options for resolving problems that are identified. These include application of mitigation measures, shifting the dates or locations of activities, or deferral of further activities. The primary objective of all cooperators must be to work together to insure that the management goals of each cooperator are met to the extent possible.

PHASE 3: Problem Resolution

Following Phase 2, the party that initially identified the problem will organize a meeting between all affected parties. The objective of this meeting will be to develop a cooperative plan which protects water quality, as well as meeting the management objectives of all parties as nearly as possible. All participants agree to the following ground rules, which are patterned after rules developed for Washington's Timber-Fish-Wildlife (TFW) Process.

1. All parties recognize the legitimacy of the goals of other cooperators, and assume that their own goals will similarly respected. Each Cooperator will give the same priority to solving the problems of others as they would give to solving their own.

2. Each party agrees to protect the other participants and the process politically within their organization and with the public.

3. All parties agree to make a conscientious effort to develop a consensus plan, and agree to be advocates for the completed plan.

4. All communications with the news media or other outside parties will be by agreement of the group. Everyone will be mindful of the impacts their public and private statements will have on the success of this effort. No participant will discuss the suggestions, comments, or ideas of another participant with the media or other non-participants.

5. Each party agrees to raise concerns as early as possible, and agrees to negotiate and evaluate alternative management options in good faith.

All parties recognize that inflexibility or refusal to recognize the goals and needs of other parties will never produce positive results.

6. Any party may leave the process at any time, but only after explaining their reasons for leaving to the entire group and attempting to resolve the problem. All normal rights, remedies, and positions remain available if the Cooperative effort is unsuccessful.

WATBAL Implementation Requirements

1. Development of "user-friendly" input capabilities for the PC version of WATBAL.

2. Development of user documentation for the PC version of WATBAL.

3. Develop a training program for WATBAL users that covers the mechanics of running the model and interpreting results.

4. Compile landtype maps and coefficients necessary to run WATBAL and make available to all Cooperators.

Long-Range Plans

1. Continued review and refinement of methodologies for assessing and analyzing cumulative watershed effects, stream mechanics, and watershed management assumptions.

2. Graphic display output for the PC version of WATBAL.

3. Direct link between a watershed model (WATBAL) and the Cumulative Effects data base.

4. Investigate the feasibility of using computer graphics to visually illustrate proposed harvest area locations based on coordinates provided in the information exchange.

These long-range items could enhance the process outlined in this report through better planning and communication.

APPENDIX K.

Environmental Quality Council

House Joint Resolution 49

Summary of Comments Received through 12/8/88

DSL Forestry Division

Designate DSL as nonpoint source water quality manager for private forestry operations; require pre-sale notification of DSL by all private landowners; use DSL foresters to inspect and review BMPs and sale layout prior to the conduct of forest practices; increase education and training; retain voluntary compliance structure

Consider timber operator licensing

Question adequacy of streamside management zone BMPs; work through Montana Riparian Association to further develop SMZ BMPs

DHES Water Quality Bureau

Basic laws, regulations and institutional arrangements for addressing forest practices and watershed effects are already in place; the principal unresolved question is the appropriate level of resource commitment by each of the programs involved

Report raises questions: BMP package lacks the full support of all interested parties; cumulative effects needs to be more fully addressed, as does monitoring the effects of BMP implementation, regulation and enforcement. The only point that seems to be clear is that the state lacks the resources to proceed with the ideal program

Focus of BMPs should perhaps be on road construction and drainage, rather than such a broad range of BMPs

Audit findings suggest greatest improvement in water quality from proper application of BMPs could be from public lands

WQB is the likely state agency to maintain oversight and program leadership because its interests are water quality and public health, not forest management

The problems found during the audits may idicate there is a much larger impact on water quality than previously recorded; need to clarifiy the

relationship between BMPs and water quality so we know the significance of BMPs and departures from them; a team approach may be appropriate

Existing laws (310, MWQA, 404) govern many land uses; many investigations of suspected forest practice act violations resulted in administrative action and cleanup, without enforcement action

DSL's proposal to be designated as NPS agency for forestry is premature; would need funding and legislation; WQB should retain oversight responsibilities.

CDs are already designated and could cover SMZ with little additional manpower or notification requirements; no additional legislation required now, but may be if this approach doesn't work

Cumulative effects coop and Flathead Basin Project indicate that there is not an absence to assess the effects of forest management on beneficial uses; 319 program as proposed will also be a source of activity; (but) we must do a better job of documenting the relationship of forest practices and WQ

Favor WQB implementation of NPS program as delineated in the 319 management plan. This would avoid different state agencies tripping over each other to get the job done

DNRC

Report clearly indicates the need for improved oversight of forest practices on all land ownerships

Endorses adopting a statewide BMP package

CDs are in good position to play an active role, but need additional staff to play a role in monitoring forest practices; recommend 2 field staff (NW and SW) to develop training programs for CD supervisors; review road plans and SZ management on 310 inspections; randomly inspect private sales; assist in the drafting of local sediment control ordinances; coordinate a biannual audit; assist DSL in developing and conducting education program for contractors and operators

DFWP

Successful program will require specific guidelines for acceptable practices; an education program for loggers and sale administrators; a notification requirement so that appropriate agencies know where sales are occurring; pre-sale assistance; and authority by some agency or interagency team to inspect and, when necessary, to require reasonable measures that will mitigate or prevent damage to watersheds

Coordinated agency approach appears to be the most efficient use of resources (including regional water quality managers, BHES adoption of

BMPs, operator licensing, and interagency teams); regional water quality managers would be a good preventive approach

BMPs may not always protect watersheds; need to monitor them

Need to consider woody debris recruitment

USFS Region 1

Support BMPs as the appropriate means of preventing NPS pollution from forest practices; monitoring BMPs is a feasible surrogate for direct water quality or beneficial use monitoring while a database is being developed

Would like to continue to work with committee to refine SMZ BMPs;

Agrees that USFS may need more attention to oversight of forest practices; is reviewing audits (MT and ID) and preparing an action plan for NPS control

BLM Montana State Office

Are audited sales representative of current or future? Should review more high-hazard sales because of the potential for watershed effects and the fact that they may become more common

310 process should address headwater intermittent streams that are now left out; do CDs have the capabilities to adequately implement 310?

Best way to achieve WQ standards are (a) to apply BMPs during road construction, maintenance and drainage, and (b) to implement riparian practices that protect stream integrity. Audits indicate improvement is needed

BMPs need to be tailored to site conditions, including high-hazard sites

Some form of enforceable, mandatory BMPs will probably be necessary to achieve resource protection, especially in SMZs

BLM Miles City

Generally editorial or clarification comments

Montana Society of American Foresters

Position approved by membership is to:

1. implement an expanded educational program to insure that all landowners are aware of and understand BMPs
2. enact legislation to require reporting of intent to engage in timber harvesting and associated practices so on-site evaluations by

forestry professionals can be conducted. Implementation of BMPs would be solely at the discretion of the landowner

Authorize DSL, CDs, and DHES the necessary budget and personnel to implement this program; fund DSL Forestry BMP Education Project

Monitoring needed; audits may be OK for now, but quantitative approach would be desirable in some areas

Cedron Jones

Forest practice act, emphasizing education and sale planning but backed up by enforcement capabilities

Clint Carlson

Ample evidence that current forest practices are causing a decline in soil fertility; undesirable species conversion is also occurring

Adopt a forest practices act, and legislate to protect SMZs

DSL should administer the act

Robert Hammer

Support forest practices act

Two major principles to control forest watershed sediment are to control sediment from road construction and to maintain woody debris for stream structure;

Slash-filter windrows are also effective and should be mandatory during road pioneering

Streamside leave trees should be mandatory (5-10 per 100 feet of stream)

Form a new interagency group to work on technical forest watershed issues, like SMZs, monitoring of BMPs, criteria for effects on beneficial uses, watershed thresholds and cumulative effects; include fisheries expertise

Merle D. Lloyd

Erosion and sedimentation have been overemphasized, especially when compared to historic land management practices

Need flexibility in BMPs, as suggested; BMPs should be distributed

American Fisheries Society

Proposed cost-effective alternative to a forest practices act:
-- use rulemaking process to adopt BMPs under the Water Quality Act to provide a bottom-line protection against abuses
-- education program for loggers and sale administrators; certification or licensing should be considered
-- accountability is mandatory; need to establish a network of 4 regional water quality managers to review timber harvest plans and inspect timber sales; could also assist CDs

Plum Creek Timber

BMPs are being applied and effective; voluntary approach is working

Endorse HJR 49 BMPs

Expand BMP education programs, coordinated through DSL and supplement by other efforts

Periodic audits, coordinated by DSL and including ID teams, are the best way to monitor BMP use and effectiveness

Strongly support cooperative programs: Flathead and CWEC

Do not believe that new legislation is warranted

Rep. Swift

Landowners and operators are knowledgeable about BMPs; audits indicated practices were sound

No legislation necessary, existing laws are OK; operators should continue to notify DSL; DSL could monitor and work cooperatively on BMPs

Stoltze/Columbia Falls

Too much emphasis in the report is placed on numerical ratings; did not indicate the actual on-the-ground efforts to apply BMPs;

Endorse HJR 49 BMPs; no special treatment needed for SMZs;

Support continuation of voluntary program;

Support expansion of education, through joint government/private efforts; DSL as lead agency

DSL to coordinate future audits as a means to monitor application and effectiveness of BMPs

Existing law on notification is adequate for notification purposes; no legislation necessary

W-I Forest Products

Audits revealed high compliance

Support HJR 49 BMPs on a voluntary basis; support continued audits

Stoltze-Conner Lumber

Very adequate performance by operators; voluntary apparently working;

Negative tone to report

BMPs are adequate; I/E by DSL; DSL to use hazard reduction program as initial contact point for providing info and for casual monitoring

Jay Penny

Harvest practices are good; educational program should work

If a program is deemed necessary, DSL should administer

Montana Audubon Council

Significant detrimental effects are occurring; need to probably regulate in SMZ

Approve of emphasis on monitoring stream quality; must consider potential cumulative effects

Endorse forest practices act; if no act, need to give DSL rulemaking authority for SMZ

Establish a new interagency group to address technical issues

Consider funding from industry, sportsmen and recreationists; proper funding will be necessary

Champion International

Strongly supports the current cooperative educational approach when combined with the SAF position paper on increased education and voluntary compliance

Use EQC-developed BMPs statewide

Legislative goal should be to encourage continued improvement of forest practices and to coordinate existing state resources; DSL would be best to coordinate interagency program

Supports periodic review through audits

Forest practice improvements have benefits, but must be cost-effective; voluntary programs works

Montana Logging Association

Supports HJR 49 BMPs, and these adequately address SMZ

Voluntary BMP implementation; support DSL as educational lead; periodic audits are OK

No legislation needed

Flathead Conservation District

CD doesnt have time or people to administer a program; DSL would be appropriate agency; education and training are important

CDs could be unofficial consultants to DSL

Stoltze/Dillon

Overall, industry has done a very commendable job

Endorse the BMPs; continue the voluntary cooperative approach -- it has not been in place long enough to determine its effectiveness

Distribute BMPs; conduct audits every 2 years

Louisiana-Pacific

Voluntary implementation of HJR 49 BMPs, including in SMZs; update new information into BMPs

Have DSL coordinate an ongoing education program; conduct periodic field audits

Montana Wood Products Association

Support periodic field audits coordinated by DSL; support HJR 49 BMPs; support and would be willing to participate in BMP education program; existing voluntary programs are working well and should be continued;

The existing legal requirement to notify DSL before cutting timber can be utilized to distribute BMP information to private landowners; no new legislation is necessary

Western Environmental Trade Association

Similar to MWPA

Trout Unlimited

BMPs are a cost-effective way to protect watersheds, but may not be effective in high-hazard situations; some monitoring of WQ should be done to evaluate BMP effectiveness in these sites

Not satisfied with SMZ BMPs, which do not adequately address use of equipment, width, shade trees, and ground cover; difficult to have general recommendations to fit all sites

Cumulative watershed effects is a concern; coop is not an open public process and there have not been deferments to address potential water yield problems; BMPs are not the answer for cumulative effects

Current program direction is unacceptable, as state not meeting its responsibility. Agree with Option C, Issue #1, but would like legislation to give DSL foresters authority to require specific BMPs at specific sites; if recommended practices are able to be ignored, this could be construed as rejection of a "reasonable" practice and thus a cause for action by WQB. Support timber operator licensing and regional water quality managers.

Support monitoring the actions taken in response to HJR 49

Five Valleys Audubon

Notes that study is limited to watershed effects, not full range of forest practice effects

Cumulative effects were not adequately covered; this is a concern as cutting magnitude increases and headwater areas are logged; CWEC does not include public participation, is limited to western part of MT and does not address full range of watershed issues -- see Idaho settlement

Audits did not meet high-hazard target

Study of funding strategies would be relevant

Need a package approach, including clearer definition of agency roles, implementation and funding; need to establish a primary responsibility for implementing the package developed through the EQC process so we don't lose the momentum of the study

Jack Peters

The bill infringes on free enterprise; concern over delay and regulation; education and restrictions on road construction will help; don't need new laws or expenses

Montana East Side Forest Practices Committee

Adopt HJR 49 BMPs statewide; voluntary program is working and legislation is not necessary; support DSL education program

Howard McDowell

Agree with SAF, but need to include operators in education and notification

Also, conduct sample monitoring by an independent ID team to assess application and effectiveness and establish and EQC oversight committee to periodically examine the effectiveness of the program

Need to consider how to include federal and tribal in a total program

Bill Magnuson

Adverse cumulative watershed effects is the single most dangerous situation. We have never had this scale of harvest before and we need to be cautious; risk to watershed is too high from this harvest level; we need more cooperation and possibly legislation to protect the public watershed values

Educational and cooperative approach is nice but some enforcement is also necessary

Sequoia Forest Industries

Recommend continued use of voluntary BMPs