MONTANA
Forestry Best Management Practices

2024 Forestry BMP Field Review Report

The Montana Department of
Natural Resources
& Conservation

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ACKNOWLEDGMENTS

In 2024 the Forestry Assistance Bureau (FAB), Forestry and Trust Lands Division, Montana Department of Natural Resources and Conservation (DNRC) completed the Forestry Best Management Practices (BMP) Field Reviews. These review cycles are conducted every even-numbered year (two-year frequency). The purpose is to determine whether Montana's voluntary BMPs are being applied correctly and are maintaining their effectiveness in protecting Montana's water quality.

Many people have given up their time and energy towards this review effort. Thank you to the Field Review Team members who have taken time off from their own work to travel across the state, work long days in the field, make difficult decisions, and have conducted themselves in a highly professional manner. The Environmental Quality Council, the Governor's, those whose office supplied information to the selected sites, and those who gave us access to their private lands also deserve recognition for their hard work and dedication to Montana's water quality. The Forest Products Industry, the U.S. Forest Service, the Bureau of Land Management, MT Department of Natural Resources and Conservation Trust Land Management Division, University of Montana-Lubrecht Experimental Forest, MT Fish, Wildlife, and Parks, and Family Forest Landowners deserve a big thank you for their cooperation in providing field review site information and/or team members.

A special thanks to Beth Dodson who put in an exorbitant amount of work towards leading the three teams and ensuring fieldwork/reviews went smoothly. Marc Vessar also deserves a special thank you for taking over BMP review process in 2022. Both Beth and Marc have provided valuable guidance and feedback throughout the writing of this BMP field review report and the changes that have been made couldn't have happened without their support.

Sincerely,

Jordan Buxton

EXECUTIVE SUMMARY

The Forestry Best Management Practices (BMP) field review process is used to evaluate whether BMPs are being applied appropriately and correctly. They are also used to determine if the applied BMPs are effective in limiting non-point source pollution from timber harvest operations in Montana, i.e. is water quality being protected? The DNRC Forestry Division evaluates forest practices for BMP implementation every two years and reports the findings to the Montana Environmental Quality Council (EQC), the Legislature, the Governor's Office, and the public at large. This report summarizes the findings of Montana's 2024 Forestry BMP Field Reviews and compares the results from historic BMP trends.

In 2024, three interdisciplinary teams conducted field reviews. Ideally, each team was composed of a fisheries biologist, a forester, a hydrologist, a representative of a conservation group, a road engineer, a soil scientist, and a non-industrial private forest (NIPF) landowner or timber harvesting professional. A single statewide field review team leader was present for all field reviews to help ensure consistency. The DNRC used established site selection criteria to select 31 timber harvest sites that completed harvest operations in 2022 or 2023. The field review teams (FRT) evaluated a maximum of 61 BMPs, 49 of which are Forestry BMPs and 12 are associated with the Streamside Management Zone (SMZ), including one for fish passage. At each site, the teams rated the application and effectiveness for each applicable BMP on a five-point scale.

A total of 31 field review sites were evaluated for BMP application. Field review results showed that across all ownerships, BMPs were properly applied 97% of the time. Although 13 harvest sites had at least one instance where a BMP was inadequately applied, most of these departures (28 out of 34) were minor and did not cause erosion or deliver material to a stream. Three sites (10%) had one or more major BMP departures in application which was a slight improvement from the last cycle (2022). The application of the eight high-risk BMPs was also analyzed separately because these BMPs are the most important for protecting soil and water resources. Of these high-risk BMPs they were properly applied over 87% of the time.

The teams evaluated the same 31 sites for BMP effectiveness. Results showed that across all ownerships, BMPs were effective in protecting soil and water resources over 98% of the time. Of the 31 sites, 10 (32%) had one or more impacts for BMP effectiveness. This is a decrease in 4% of sites with impacts from the 2022 audit cycle. Minor impacts in effectiveness produce minor impacts to soil and water resources; for example, eroded material reaches draws but not streams. Four (13%) of the sites had one or more major departures in BMP effectiveness compared to 16% in 2022. Of the eight high-risk BMPs 95% successfully provided adequate protection to soil and water resources.

Once again, the greatest frequency of departures from the BMPs, and the most identified impacts, were associated with inadequate road maintenance and insufficient road surface drainage. This report includes a list of the most problematic BMPs in Tables 5 and 6.

The FRT also evaluated the application and effectiveness of Montana SMZ Law. Out of the combined 384 application/effectiveness ratings, only one major application departure and one corresponding major/temporary effectiveness impact were identified as a result of sidecasting of material into a stream during road maintenance.

Table 1: Summary of 2024 BMP and SMZ Application and Effectiveness, by Ownership

Practice	State	Federal	Industry	NIPF	Totals
BMP Application	97%	95%	98%	100%	97%
BMP Effectiveness	98%	98%	99%	100%	98%
SMZ Application	100%	99%	100%	100%	99%
SMZ Effectiveness	100%	99%	100%	100%	99%

Introduction

(History)

The forest lands of Montana provide for the headwaters of several major river basins that produce large quantities of water. This water nurtures some of the West's best fisheries and has many uses such as for irrigation livestock domestic, recreational, and industrial purposes. These same lands grow the timber resources to sustain one of Montana's major industries, the forest products industry. All the products from Montana's 22.5 million acres of forested land contribute to Montana's economy and way of life.

The approach that Montana uses to protect soil, habitat, and water quality during a timber harvest operation involves regulatory and non-regulatory approaches. The non-regulatory, Forestry BMPs approach started in the 1970's. These BMPs provided guidance as minimum protection standards to protect water quality. In 1987 Congress amended the Clean Water Act to add Section 319 to address non-point sources of pollution. Section 319 directed all States to develop non-point source pollution plans to address the non-source pollution problem. Montana's Forest BMPs provide Section 319 compliance.

At the same time, concern arose over the impacts of forest management on Montana's watersheds prompted the 1987 Montana legislature to pass House Joint Resolution 49 (HJR-49). This resolution directed the Montana Environmental Quality Council (EQC) to study "how current forest management practices are affecting watersheds in Montana" (Zackheim 1988). EQC established a BMP technical committee that developed Montana's first statewide BMPs in 1987. In 1989, After two years of work, an interdisciplinary working group (BMP Working Group) released the revised Forestry BMPs. Since that time, the BMP Working Group has overseen the biennial review process. In the interim between 1996 and 2010, the BMP Working Group reviewed and revised the 1989 BMPs. The last revision was to address biomass in the BMPs. These changes are minor and don't have a direct impact on the methodology that is used in the field review process. The 2006 version of the Best Management Practices for Forestry in Montana (Appendix A) was adopted for use in the 2010 field reviews and has been used since.

As part of the HJR-49 field review teams conducted the first statewide assessment of forest practices for BMPs during the summer of 1988 (Zackheim, 1998) in 1989 the University of Montana, under the Flathead Basin Water Quality and Fisheries Cooperative, reviewed more sites for BMPs in the Flathead River drainage (Ehinger and Potts, 1990). The Montana Legislature then directed the DNRC to conduct a further series of statewide BMP field reviews every two years on the even year starting in 1990-present. (Shultz, 1990 and 1992; Frank 1994; Mathieus, 1996; Fortunate al., 1998; Ethridge and Heffernan, 200; Ethridge, 2002 and 2004; Rogers, 2006; Ziesak 2008 through 2018, Vessar 2022).

Before 1989, Forestry water quality was addressed through a voluntary approach as part of Montana's 1988 non-point source assessment and management plan. 1989 Montana legislature enacted the BMP Notification Law (76-13-101 MCA), this requires private landowners to notify DNRC before harvesting

timber. The DNRC then provides information and technical assistance on how to apply BMPs in the logging operation under this law, Forestry BMP information is sent to landowners. The implementation of Forestry BMPs is administered within a non-regulatory framework.

Since October 1991 the Streamside Management Zone (SMZ) law (77-5-301 307 MCA) has regulated forest practices along streams. This law prohibits certain forest practices along stream channels and describes/ directs suitable streamside management practices. The SMZ Rules 936.11.301-310 ARM) became effective on March 15, 1993, and were intended to help define and clarify the SMZ law. The 1992 BMP field reviews did not evaluate compliance with the SMZ law because most operations reviewed were completed before the effective date of the rules. Beginning in 1994, the field reviews were designed to provide information on the application and implementation of the SMZ law and rules, using a supplemental SMZ questionnaire. In 1998 the format and five-point scale used to evaluate the BMPs for application and effectiveness was also adopted for evaluating the SMZ law and rules.

The EPA considers the BMP field review process to meet their definition of implementation monitoring. Implementation monitoring is an acceptable surrogate for water quality monitoring which is a more quantitative, time-consuming, and expensive approach. Water quality varies naturally due to variability in geology, landforms, soils, and weather/climate events. Due to this variability, investigators must collect a large number of samples over an extended period of time to accurately characterize water quality.

When properly applied Forestry BMPs can limit non-point-source pollution from forestry operations such as sediment from a road or timber harvest. Since 1990 BMPs have been consistently reviewed to evaluate whether BMPs are being properly applied and if they are successful at limiting non-point source pollution. In Montana, interdisciplinary team members use qualitative implementation of field reviews to determine if BMPs are being applied and whether they are controlling erosion. Since BMPs are recognized by state and federal agencies as a method to control non-point source pollution, the application and effectiveness of BMPs are included as part of Montana's program. States are increasingly relying on qualitative surveys, using interdisciplinary teams to assess forest practices on-site to monitor their silvicultural non-point source control programs (NCASI, 1988).

Through Montana DNRC, a technical working group has been appointed to oversee the BMP Process since its inception and provides recommendations to the DNRC. The Working Group members represent a broad range of interests in forestry in Montana. Several members also serve on the field review teams and have been involved with the program for several years.

Methods

Objectives

Except for 2020 (due to the covid pandemic) BMP field reviews have been conducted every two years since 1990. The 2024 cycle is the 17th in the review process. The 2024 field reviews were conducted with identical objectives and criteria as the previous field reviews to produce data that is comparable to previous years.

The objectives of the BMP field reviews are to:

1. Determine the degree to which BMPs are being applied to timber harvest operations;
2. Evaluate the effectiveness of BMPs in protecting soil and water resources;
3. Provide information on the implementation of the SMZ law and rules and assess the general effectiveness of SMZs in protecting water quality;
4. Provide information to focus future educational or study efforts by identifying subjects and geographic areas in need of further attention or investigation; and
5. Provide information on the need to revise, clarify, or strengthen BMPs.

Study area

The study area is the State of Montana. For 2024 the state was divided into three geographical regions, Northwest, West, and Central/East. For administrative ease, the regional breaks are located along county lines. The regional breaks can be flexible based on logistics of grouping near-by sites once locations are known.

Site selection

Site selection criteria were changed for the 2024 field review process to broaden the available sites for selection. The minimum criteria to be placed in the pool for a field review are:

1. Sites had harvest, cleanup, and close-out activity within the two years prior to the 2022 field review, and the sale or major segment/subdivision of the sale was closed or released;
2. Minimum actual harvest size of 5 acres; and
3. Minimum volume per acre: 1,000 board feet.

High-risk sites

Each site was assigned risk priority points based on the following criteria then summed for each site. Each criterion was assigned a point value, the more total points the higher the risk. As in previous years, the goal is to select two-thirds of the field review sites from the highest-risk locations within each landowner category and one-third from the lower-risk sites. The relative risk rating was developed to have an equitable and trackable approach to identify higher-risk sites. It should be noted that this methodology does not assign a given risk rating threshold for "high-risk" but is a relative to the risk ratings of other sites within the landowner category that are in the evaluation pool.

The risk points rating are as follows:

1.	Multiple new or replacement class 1 or 2 stream crossings	**5 points**
2.	Single new or replaced class 1 or 2 stream crossing	**4 points**
3.	New road construction	**3 points**
4.	Reconstruction	**2 points**
5.	SMZ harvest	**2 points**
6.	Ground-based skidding on slopes over 40% (including tethered)	**2 points**
7.	Existing stream crossings	**1 point**

a. Stream crossings of concern are class 1 and 2 only. Class 3 streams are not considered for risk factors but potentially could be assessed during a field review.
b. The only stream crossing considered in determining risk is the stream crossings on the landowner's property.

Stream class is defined in the Administrative Rules of Montana 36.11.312.

Once the top third of the sites by risk were identified within each category, the appropriate number of sites two-thirds of the total needed were randomly selected. Same for the "low-risk" sites one-third of the total number of sites is needed for that category. In 2024 only 58% (18 of 31) of the sites reviewed met the high-risk rating. This is due to the limited sites within SMZ harvest and/or road construction/reconstruction.

Road Definitions:

New Construction: Any roads constructed after January 1, 2020, used to access associated harvest areas.

Reconstruction: An existing road to a different set of design standards, such as widening roads, altering cut or fill slopes, culvert installation and/or replacement. For the purpose of field reviews, road work consisting of the installation of road drainage feature and/or general road maintenance with no other reconstruction activities should not be submitted as "reconstruction".

Table 2: Percentage of Sites with High-Risk Criteria

Ownership Group	Number of Sites	Number of High-Risk Sites	Percentage of High-Risk Sites	Number of Sites with SMZ Harvest	Percentage of Sites with SMZ Harvest
State	6	4	67%	0	0%
Federal	15	9	60%	1	6%
Industrial	5	3	60%	2	40%
NIPF	5	2	40%	2	40%
All Sites	**31**	**18**	**58%**	**5**	**16%**

High Risk BMPs

Numbers and percents don't give the full picture of the application and effectiveness of Montana's Forestry BMPs. A low percentage of misapplied BMPs can still result in major impacts. All evaluated practices evaluated can affect water quality, but the magnitude of the potential impacts can vary. For example, drainage from a skid trail a mile from a stream may not have as direct of an impact on a stream as an adequate road surface drainage at a stream crossing. To gain insight regarding the practices with a higher potential to impact water quality, eight high risk BMPs are identified and analyzed separately. These BMPs are among the most important for protecting Montana's water sheds. Throughout the paper BMPs with an asterisk (*) will indicate that BMP as high-risk.

Sample size and distribution

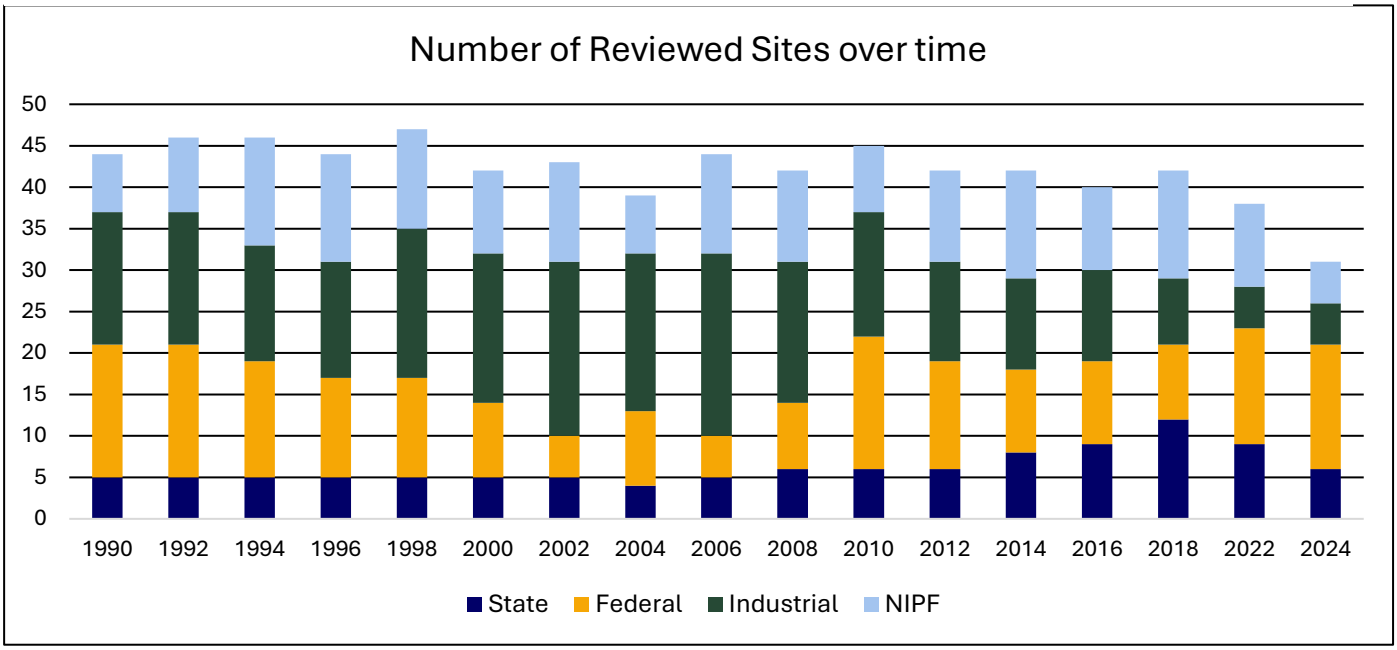
The target field review sites are distributed across the state by geographical regions and land ownership groups. The field review process recognizes four ownership groups: 1) State, consisting of State of Montana Trust lands, Lubrecht Experimental Forest (U of M), and MT Fish Wildlife and Parks ; 2)Federal, consisting of U.S. Forest Service/Bureau of Land Management lands; 3) Industry, consisting of private industrial forest lands; 4) NIPF, or non-industrial private forest lands. The basis for field review site distribution is the proportion of the total statewide harvest volume that is harvested within each region by each ownership group. The sites are allocated proportionally among the regions by volume harvested. Harvest volumes were averaged over the previous 5-year period with data from annual "Cut-by-County Report" this includes all ownerships within the state.

A total of 32 sites were selected along with a few alternative sites. The purpose of the alternative is to ensure an appropriate number of site audits are met. Out of the 32 selected sites and the alternative sites 31 were reviewed during the 2024 BMP cycle (See Figure 1 for historical site information).

Finding NIPF field review sites that meet the minimum or higher priority criteria is an ongoing challenge (see Site Selection above for criteria details) however, the 2024 audit cycle identified enough sites that met the criteria. Over the last few cycles there has been a downward trend in the number of NIPF landowners constructing roads and installing stream-crossings. This trend has impacted on the number of NIPF sites that meet the minimum criteria.

The 31 sites are a representative sample of the logging operations that met the selection criteria that concluded in 2022 or 2023. The selection criteria restrict the sample sites to sites with timber harvest and timber management activities have the potential to impact water quality.

Figure 1: Historical Number of Sites Reviewed by Ownership Group



*See Appendix B for the list of 2024 reviewed sites.

The Rating Form:

The 2024 rating form (see Appendix F for the full form) used by the FRT was identical to the previous review cycles. There are 49 BMP practices, 11 SMZ practices, and one fish passage (on new culvert installs) that were evaluated at each site. Each practice is rated on application and effectiveness; the rating is based on a 5-point scale. The rating guide is adapted from Ehinger and Pots, 1990. The rating form includes a short glossary of terms used in the ratings which is shown below. The terms were initially defined before the 1990 field reviews and have remained the same to maintain consistency.

BMP Glossary

Adequate:	Small amounts of material eroded; the material does not reach draws, channels, or floodplains.
Minor:	Some material erodes and is delivered to draws, but not to streams.
Major:	Material erodes and is delivered to streams or annual floodplains.
Temporary:	Impacts lasting one year or less; no more than one runoff season.
Prolonged:	Impacts lasting more than one year.

Application: The FRT utilized a decision tree to rate the application of BMP. The FRT first determines if a BMP is applicable to the site for example, if a site has no stream crossings the BMPs pertaining to stream crossings are not applicable to the site and therefore not evaluated. Next, the FRT would determine if the BMP was applied to the correct technical standard, at the correct frequency, and in the proper locations. The scores of the rating guide are 1-5; scores of 1, 2 or 3 are referred to as "departures".

5 - Operation exceeds the requirements of the BMP
4 - Operation met the requirements of the BMP
3 - Minor departure from the intent of the BMP
2 - Major departure,
1 - Gross neglect of the BMP.

Effectiveness: This rating addresses how well applied BMP performed at limiting resource impacts and keeping soils out of water. This rating answers questions concerning impacts. For example, has the application or misapplication of a particular forest practice increased or decreased the likelihood of, or actual occurrence of sediment delivery to streams? The lack of effectiveness results in the impacts. The rating descriptions are similar to those in the application rating guide.

5 - Improved the protection of soil and water resources over the pre-project condition
4 - Adequate protection of soil and water resources
3 - Minor and temporary impact on soil and water resources
2 - Major and temporary, or minor and prolonged impact on soil and water resources
1 - Major and prolonged impact on soil and water resources.

Field review site inspections

Field reviews were conducted from early July through early August of 2024. Field reviews are made of the FRT members, landowner representatives, and observers. Before entering field review area (including roads used for hauling) the group discusses the specifics of the review process, and maps and review sheets are distributed throughout the group. The landowner or logger gives a briefing on the silvicultural prescription, time of operation, and associated practices. All decisions regarding which roads, SMZ's new culvert installations, and harvest units to be reviewed are determined before the team enters the road system or harvest area. The team walks as a group and reviews the practices in the selected areas. The inspection, discussion, and rating take approximately two hours per site. Observers who attend the field reviews are not part of the review team.

Limitations

In analyzing field review results, readers need to consider the limitations of the techniques used in the field review. The review technique consists of a one-time field inspection and assessment. This approach documents erosion and sedimentation problems occurring in the first two years after harvest. This is generally the critical period for erosion associated with timber harvests. Some practices conducted during harvest cannot easily be evaluated during a post-harvest field review and are not considered during the field review. The assessment is based on visual appraisals of practices and impacts to surface soils and streams. The results are a "snapshot in time" of the practices and subsequent impacts. They do not necessarily reflect future impacts. During the 1998 field reviews, sites previously reviewed in 1996 and 1994–i.e., four- to six-year-old sites–were examined for long-term impacts. This information can be found in the 1998 Forestry BMP Audit Report (Fortunate et. al.).

Sites are split among the three teams. Although rating inconsistency between teams should not be overlooked, its effect is likely minor due to the interaction between teams and the continuity of experienced team members. To help promote consistency, a single team leader was used for all teams and team members participated in a calibration field review for training.

2024 Field Review Results

This section presents the results of the 2024 BMP field reviews. The results are presented in BMP applications, BMP effectiveness, high risk BMPs and SMZ results. In the spirit of improvement these results will also compare the previous field reviews. results to explore the BMPs we can improve on and celebrate the ones that we have been very successful with.

BMP Application

The *application* rating measures whether the BMP was applied and whether it was applied to the correct standards, appropriate number of times, and in the proper locations. The field review team evaluated a total of 919 BMPs on 31 sites. Table 3 displays the application ratings by ownership for all practices rated during the 2024 BMP Field Review process.

Forestry BMPs were applied adequately 97% of the time in 2024. This is a slight (1%) improvement over the 2022 review cycle. Of the 32 application departures 28 were minor (rating of 3) and four were considered major (rating of 2). It is noteworthy that in the 2022 cycle there were a total of 46 departures over 38 sites: 41 minor and 5 major.

Table 3: Application Ratings by Ownership Category

Ownership Group	Number of Practices Rated	Number and Percentage of Practices Rated in Each Category			
		Meet or Exceed	Minor Departure	Major Departure	Gross Neglect
State	200	193 (96%)	7 (4%)	0 (0%)	0 (0%)
Federal	502	479 (95%)	19 (4%)	4 (0.8%)	0 (0%)
NIPF	90	90 (100%)	0 (0%)	0 (0%)	0 (0%)
Industrial	127	125 (98%)	2 (2%)	0 (0%)	0 (0%)
All Sites	**919**	**887 (97%)**	**28 (3%)**	**4 (0.8%)**	**0 (0%)**

Table 4 shows the individual BMPs departures observed during the 2024 field review. Overall, there were mostly minor departures although four major departures related to BMPs III.C.7 and III.E.2 were noted. Maintaining erosion features through period inspection and maintenance received the most departures of any BMP accounting for slightly more than one-third of the inadequate marks.

Table 4: 2024 BMP Application Departures by Practice

BMP Number	Brief Description	"3" Rating Minor Departure	"2" Rating Major Departure	Total Departures
III.C.1*	Provide adequate drainage from the surface of all roads.	5	0	5
III.C.2	Design all ephemeral draw culverts with adequate length to allow for road width.	1	0	1
III.C.3	Design relief culverts with adequate length to allow for road fill width.	1	0	1
III.C.7*	Route road drainage through adequate filtration to ensure sediment doesn't reach surface water.	6	1	7
III.D.5	Construct cut and fill slopes at stable angles to prevent sloughing and other erosion.	1	0	1
III.E.1	Grade road surfaces only as often as necessary to maintain a stable running surface and drainage.	1	0	1
III.E.2*	Maintain erosion control features through periodic inspection and maintenance.	8	3	11
III.E.8	Leave abandoned roads in a condition that provides adequate drainage without further maintenance.	1	0	1
IV.A.6	Minimize the size and number of landings to accommodate safe, economical operation.	1	0	1
IV.B.5*	Ensure adequate drainage on skid trails to prevent erosion.	1	0	1
V.D.1	Ensure stream crossing culverts have adequate length to allow for road fill width and are maintained to preserve their hydraulic capacity.	2	0	2

The asterisk (*) next to BMPs symbolizes this is considered a *high-risk BMP*.

Photo 1: This photo depicts a departure from BMP III.E.2*: *maintain erosion control features through periodic inspection and*

BMP Effectiveness

The effectiveness rating evaluates how well BMPs protect soil and water resources. The FRT evaluated a total of 919 practices (not including SMZs) to determine the effectiveness of the BMPs. Table 5 provides a summary of the effectiveness of all practices reviewed by the ownership group. Adequate protection was provided over 98% of the time. Of the 919 BMP practices evaluated, 15 resulted in impacts. Nine with a rating of a '3' (minor and temporary impacts). Four with a rating of a '2' (major and temporary or minor and prolonged impacts) and two with a rating of a '1' (major and prolonged impacts).

Table 5: Effectiveness of BMPs by Ownership Category

Ownership Group	Number of Practices Rated	Number and Percentage of Practices Rated in Each Category			
		Adequate Protection	Minor Impact	Major/Temporary or Minor/Prolonged Impact	Major/Prolonged Impact
State	200	196 (98%)	4 (2%)	0 (0%)	0 (0%)
Federal	502	492 (98%)	4 (0.8%)	4 (0.8%)	2 (0.4%)
NIPF	90	90 (100%)	0 (0%)	0 (0%)	0 (0%)
Industrial	127	126 (99%)	1 (0.8%)	0 (0%)	0 (0%)
All Sites	**919**	**904 (98%)**	**9 (1%)**	**4 (0.4%)**	**2 (0.2%)**

It is important to note the differences between Tables 4 and 6. Table 4 shows BMPs where that were not fully *applied* and Table 6 displays the *impacts* that resulted. Departures from fully implementing a BMP may not translate directly as an impact. For example, Table 4 showed an application departure in III.C.3, III.D.5, IV.A.6 and IV.B.5, however there were no impacts due to the departures with those BMPs.

Photo 2: This picture is a good example of culvert that was design relief culverts with adequate length to allow for road fill width. This shows compliance to BMP III.C.3.

While III.E.2 received the most departures during the field reviews, this BMP did not account for the largest number of impacts. Instead, III.C.7—*route road drainage through adequate filtration zones before entering a stream*— was noted for the most impacts (6) including three major/temporary impacts. This rating indicated that while sediment was reaching surface water, the FRT determined that the impact would last less than one year/runoff season.

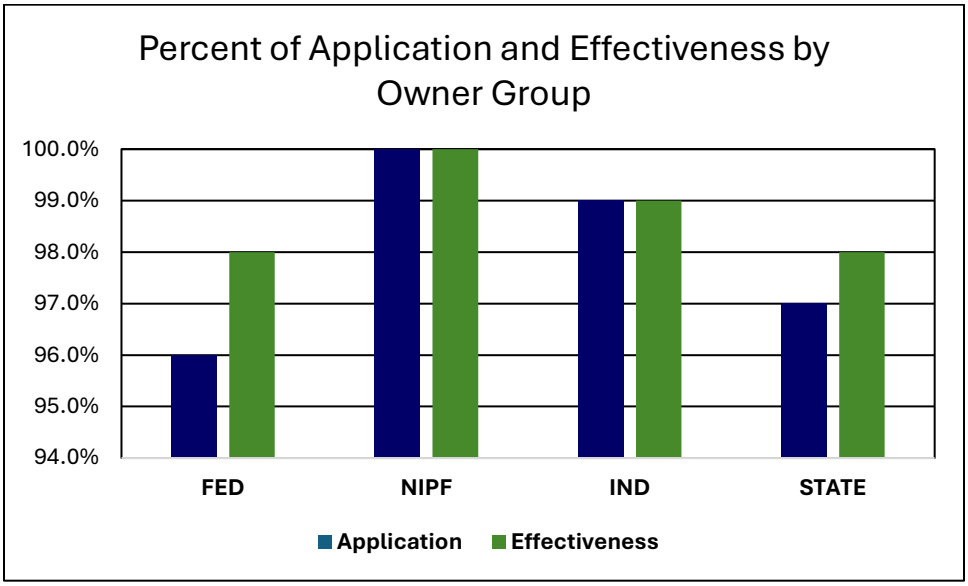
Table 6: 2024 BMP Effectiveness Ratings by Practice

BMP Number	BMP Description	"3" Rating Minor Impact	"2" Rating Major/Temporary or Minor/Prolonged Impact	"1" Rating Gross Neglect	Total Impacts for Each BMP
III.C.1*	Provide adequate drainage from the surface of all roads.	4	0	0	2
III.C.2	Design all ephemeral draw culverts with adequate length to allow for road width.	1	0	0	1
III.C.7*	Route road drainage through adequate filtration before entering a stream	3	3	0	6
III.E.1	Grade road surfaces only as often as necessary to maintain a stable running surface and drainage.	1	0	0	1
III.E.2*	Maintain erosion control features through periodic inspection and maintenance.	1	0	1	2
III.E.8	Leave abandoned roads in a condition that provides adequate drainage without further maintenance.	1	0	0	1
V.D.1	Ensure stream crossing culverts have adequate length to allow for road fill width and are maintained to preserve their hydraulic capacity.	0	1	1	2

2024 Results by Ownership Group

The 2024 field review results across all ownership groups for application was 98% for all BMP and SMZ categories combined. Across all ownerships, 2222 ratings were made for both application and effectiveness. (384 SMZs, 1838 application and effectiveness). 2024's compliance rating is over 98.5%. There was a total of 49 departures and impacts (47 BMPs and 2 SMZs). There are 25 fewer departures and impacts when compared to 2022's 81 departures and impacts, however more sites reviewed during 2022. Nonetheless, 2024 was an improvement over the 2022 results with fewer departures and impacts *per site*.

Figure 2: Percent of Application and Effectiveness by Owner Group, BMPs only



Given that all ownership groups demonstrate excellent overall compliance at the sites reviewed in 2024 there are some general observations that can be made for each ownership group.

State:

2024 BMP field reviews on state-managed lands resulted in over 97% adequate application rating; and an adequate effectiveness compliance of just over 98%. While half of the reviewed sites had at least one BMP departure, impacts were only identified on two of the six sites. None of the impacts were rated as major. For high-risk BMPs, application 'meets or exceeds' scores remained very high at 90% while adequate protection was 95%.

Federal:

In 2024 there were a total of 15 federal sites. Two of the USFS sites were implemented under the Good Neighbor Authority. One was the Bureau of Land Management. Twelve were U.S. Forest Service sites. The field reviews on federally managed lands resulted in 95% adequate application ratings and adequate effectiveness compliance at 98%. Only one departure was noted within the SMZ ratings. The

departure resulted in a major impact. High-risk BMPs were adequately applied on 81% of the rated practices and were effective 92% of the time. This is a 2% improvement in the effectiveness compared to the 2022 field reviews. This improvement is encouraging with all of the federal 'legacy' roads that were built before the current BMP standards. Bringing the roads to the current standards requires significant workload and financial investment.

Industry:

The five industry sites scored 98% for BMP application and the effectiveness score was 99%. No departures or impacts were observed on the two sites where a SMZ harvest was implemented. All landowners in Montana have placed a high priority on proper SMZ work and expect their loggers to conduct their operations accordingly. Several mills in Montana are Sustainable Forestry Initiative (SFI) members and hire highly qualified loggers with a thorough knowledge of BMPs and SMZ requirements. To become SFI members a mill must adhere to SFI standards and requirements which includes a focus on water quality, biodiversity, wildlife habitat, species at risk, and forests with exceptional conservation value. Industry application scored for high-risk BMPs were average for the review cycle at 93% application and 97% effectiveness. The application improved 3% since the last review cycle but the effectiveness decreased by 3%.

Non-Industrial Private Forest Landowners (NIPF):

The five sites reviewed on NIPF lands scored high marks across the reviews with no departures or identified impacts. These ratings have stayed relatively consistent since 2018. This review cycle NIPF application and effectiveness both scored 100% for both BMPs and SMZs. For high-risk BMPs, there was an improvement of 5% for both application and effectiveness. The final rating for the high-risk BMPs was 100%.

Comparison with previous field review results

BMPs have been very successful over the past 34 years with the application *and* effectiveness percentage ratings above 95% since 2000. To resist complacency, we must continue to look for areas to improve even if they are small. This section explores the frequency of BMP departures and observed impacts since 1990. Additionally, we will look at the BMPs with the most impact over the last 34 years. These are areas where BMPs can be improved across all ownerships.

While reviewing the data from the last 17 audit cycles over the last 34 years we were able to identify the frequency of departures and impacts of individual BMPs. Figure 3 displays the number cycles that each practice received a departure. BMPs III.C.1 and 111.C.7 and III.E.2 are the only practices that have had at least one departure every audit cycle. On the opposite end of the spectrum, the right side of Figure 3 shows the 13 BMPs that have *never* had an application departure. While 13 practices have always been applied adequately there are just five that have never been associated with an impact. This indicates that while BMPs are very effective in minimizing impacts, complete elimination of impacts is very challenging. Since the inception of field reviews, the following practices have always been adequately applied and have been successful with no impact:

BMP	Practice Short Description
III.D.9	Sediment from borrow pits and gravel pits minimized.
lV.C.6	Equipment operation (for site preparation and slash treatment) on suitable slopes only.
V.C.6	Minimum cover for stream crossing culverts provided.

Conversely, eight (8) practices have had departures, at least 50% of the field review cycles and two BMPs have been identified with application departures in every cycle with another having had a departure in all but one cycle. These practices are the top 3 BMPs that have departures most often in each review cycle and all three are high risk BMPs.

BMP	Practice Short Description
III.C.1*	Provide adequate road surface drainage for all roads.
lll.C.7*	Route, road drainage through adequate filtration zones before entering a stream.
lll.E.2*	Maintain erosion control features (dips, ditches, and culverts functional).

Figure 4 shows that BMPs III.C.1*, III.C.7* and III.E.2* had an impact on water quality at least once per review cycle. In 1992, BMP III.E.2* did not have a departure from the application, however impacts were still noted. Figure 5 displays the frequency of *major* impacts associated with each BMP. The graph presents the higher frequency of major impacts related to BMPs III.C.1* and III.E.2*. These BMPs have been the most challenging to adequately implement to prevent impacts to water quality.

Figure 3: BMPs that have had a departure during a review cycle 1990-2024.

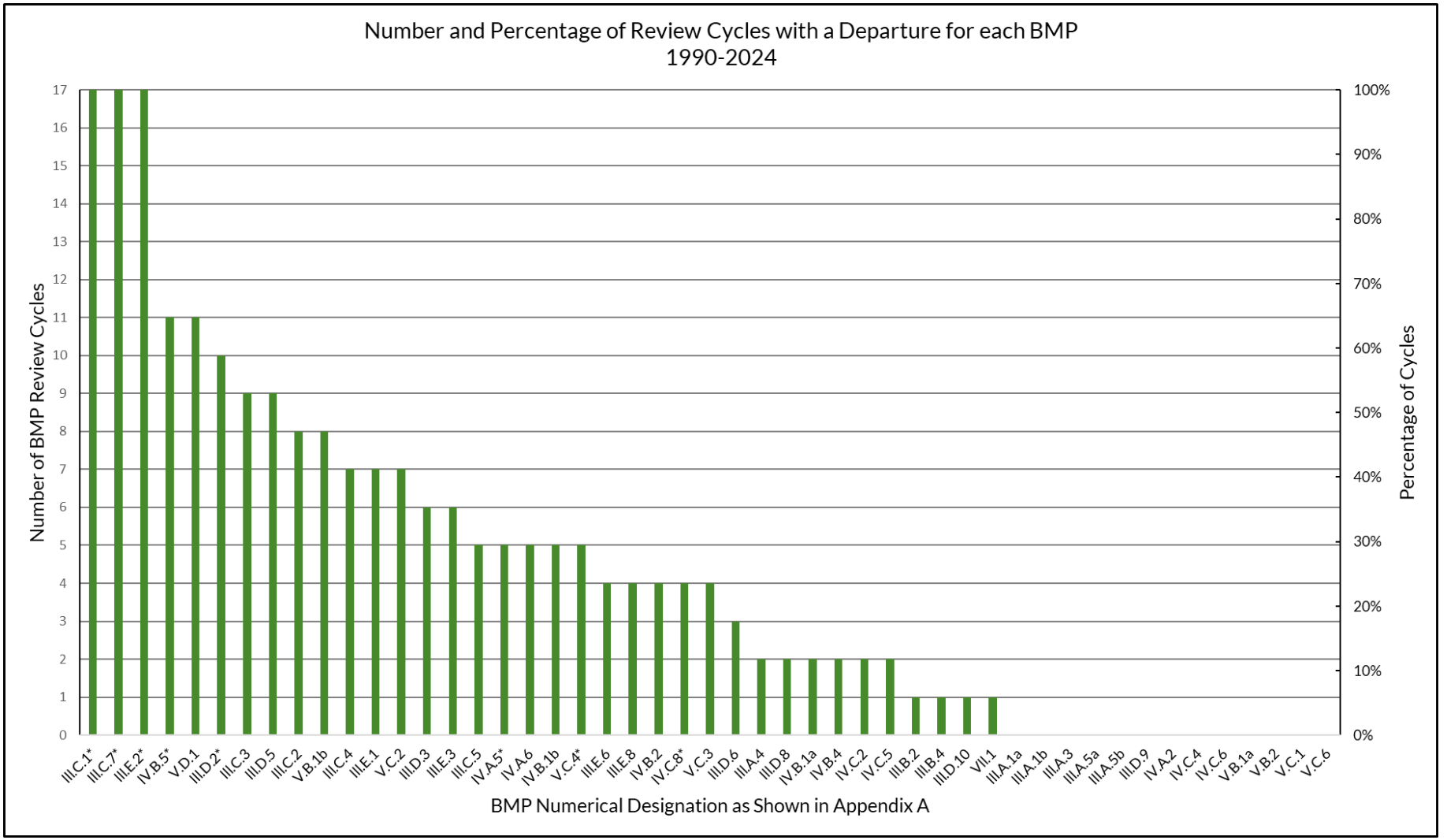


Figure 4: BMPs that have had an impact throughout review cycles 1990-2024.

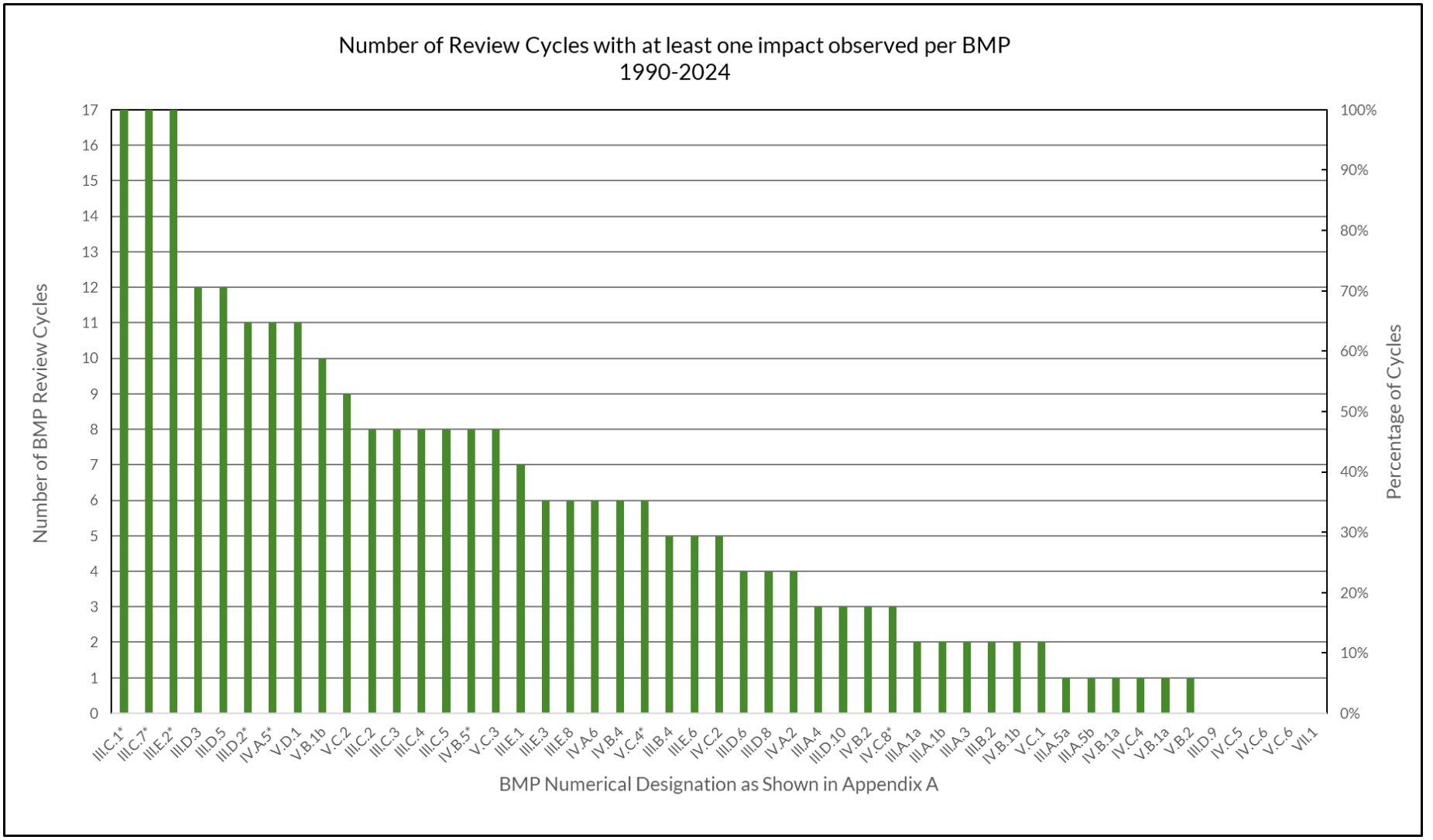
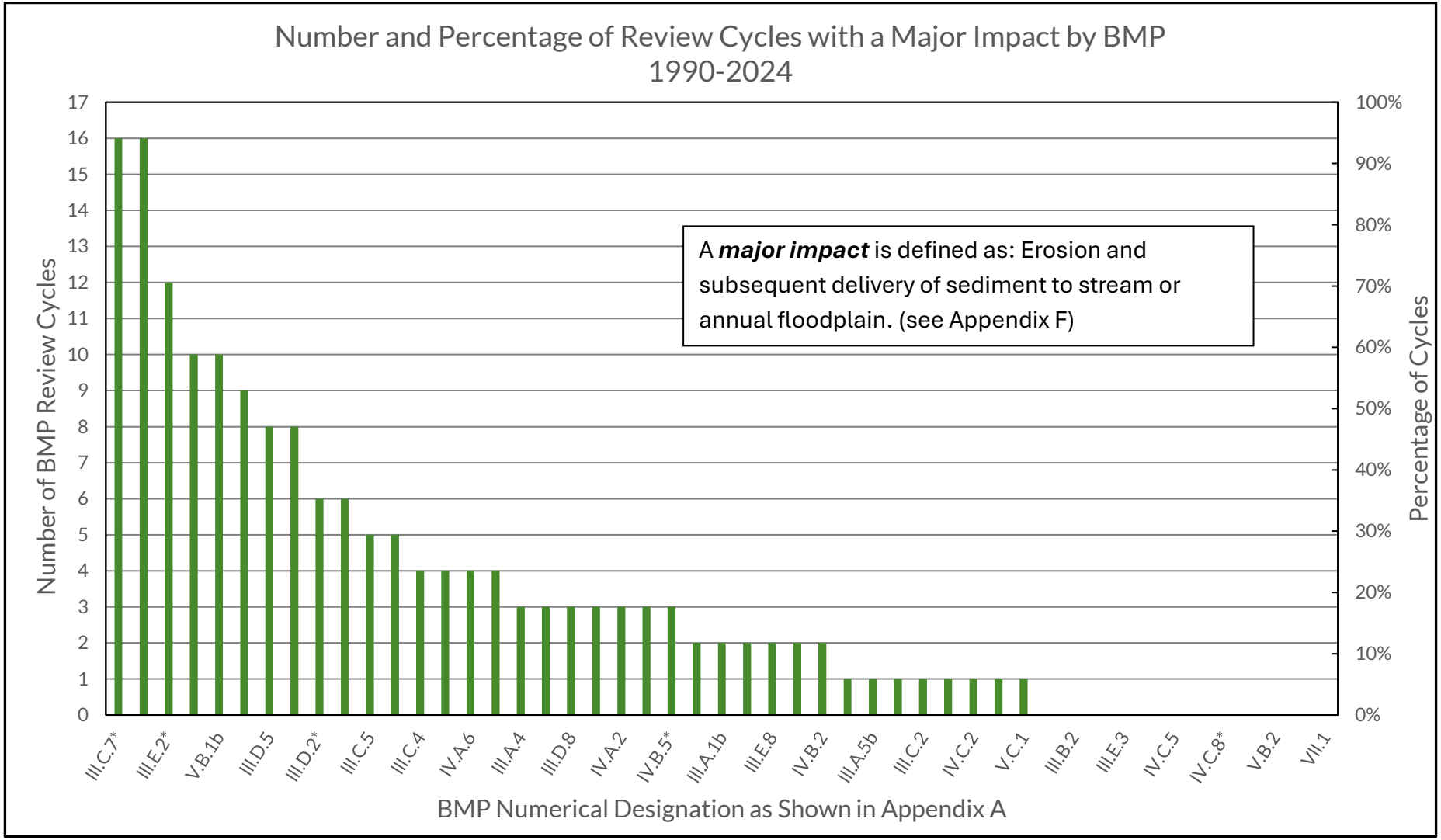


Figure 5: BMPs from review cycles that have had a major impact 1990-2024



BMP III.C.1: Provide adequate road surface drainage for all roads

As shown in Figure 4, this practice has had an on-the-ground impact during every field review cycle. All but one on those cycles, a major impact was observed by the field review team. Table 7 shows the inadequate effective ratings over the last 10 field review cycles for the III.C.1, which has had at least one departure every cycle. This practice has proved to be very challenging, especially on large road systems with legacy roads.

Table 7: BMP III.C.1 Impacts over the last 10 review cycles

III.C.1: Provide adequate road surface drainage for all roads.			
Review Cycle	*Impact Description and Rating*		
	Minor (3)	Major/Temporary or Minor/Prolonged (2)	Major/Prolonged (1)
2004	1	2	0
2006	1	0	0
2008	7	1	0
2010	0	2	1
2012	1	4	0
2014	2	2	0
2016	3	0	0
2018	6	1	0
2022	2	2	1
2024	2	0	0
Total	25	14	2

Photos 3 and 3a: These pictures of the same location depict a lack of road surface drainage resulting in road surface erosion and sediment movement. Adequately constructed and properly spaced drainage feature (such as drain dips) would reduce the volume of water and erosion potential.

BMP III.E.2: Maintain erosion control features (dips, ditches, and culverts functional).

Table 8 shows the impact of BMP III.E.2, which maintains erosion control features. This BMP has had a departure every year other than 1992. Similar to practice III.C.1, this BMP emphasizes erosion control features are important to reduce erosion from road surfaces and minimize the risk of sediment so streams on other bodies of water. During field reviews, teams identify deficiencies in road surface drainage and determine whether the impact is a result of providing adequate drainage features or *maintaining* existing features. Great care is taken to avoid assigning 'blame' to more than one BMP.

Table 8: BMP III.E.2 Impacts over the last 10 review cycles

III.E.2: Maintain erosion control features (dips, ditches, and culverts functional).			
Review Cycle	*Impact Description and Rating*		
	Minor (3)	Major/Temporary or Minor/Prolonged (2)	Major/Prolonged (1)
2004	3	0	0
2006	0	1	0
2008	6	1	0
2010	1	0	1
2012	3	2	0
2014	2	0	0
2016	2	1	0
2018	2	1	0
2022	4	1	0
2024	1	0	1
Total	**24**	**7**	**2**

Photo 4 (left) shows a drain dip that need some minor maintenance to remove water from the road surfaces. **Photo 5** on the right displays a 'flapper' or water diverter that should be replaced in order to be effective.

III.C.7: Route, road drainage through adequate filtration zones before entering a stream.

Table 9 shows the effectiveness ratings associated with BMP III.C.7 since 2004. Surfacing roads can help decrease surface erosion, but vegetation between roads and surface water serves to filter sediment from runoff. When vegetation is insufficient to filter sediment, installing slash filter windrows, wattles or rock can be used to reduces the risk of sediment delivery to streams or other bodies of water. This is considered to be a "high risk BMP' because when not properly implemented, the risk of sedimetn delivery is relatively high due when in proximity to surface water. Over the last 10 field review cycles, there have been more major impacts than minor for this practice.

Table 9: BMP III.C.7 Impacts over the last 10 review cycles

III.C.7: Route, road drainage through adequate filtration zones before entering a stream.			
Review Cycle	*Impact Description and Rating*		
	Minor (3)	Major/Temporary or Minor/Prolonged (2)	Major/Prolonged (1)
2004	0	3	1
2006	0	3	1
2008	1	3	0
2010	1	3	2
2012	0	1	0
2014	5	1	0
2016	2	0	0
2018	1	1	1
2022	1	2	1
2024	3	3	0
Total	**14**	**20**	**6**

Photo 6: A slash filter used next to a road to provide filtration of runoff.

BMP Number	Practice Short Description
III.A.1a	Minimize the number of roads necessary
III.A.1b	Use existing roads unless aggravated erosion
III.A.3	Fit the road to the topography by locating roads on natural benched/contours
III.A.5a	Minimize the number of stream crossings
III.A.5b	Choose stable stream crossing sites.
III.D.9	Minimize sediment production from borrow pits and gravel sources
IV.A.2	Use the logging system that best fits the topography, soil, and season
IV.C.4	Scarify the soil only to the extent necessary to meet the resources management objectives
IV.C.6	Carry out scarification on steep slopes in a manner that minimizes erosion.
V.B.1a	Cross streams at right angles, if practical
V.B.2	Avoid unimproved stream crossings.
V.C.1	Minimize stream channel disturbances and related sediment problems during the construction of roads and installation of stream crossing structures.
V.C.6	Minimum cover for stream crossing culverts provided.

The BMPs above are very important to note because over the last 34 years there has never been a departure with these BMPs. Each cycle the BMP Review Teams provide over 1000 BMP ratings. Some BMPs have had more issues than others; some BMPs are broken down into subsections or are very similar to each other. I would pose the question; Could some of these BMPs be combined so the BMP Audit teams can focus and give more time on the BMPs that show to have more consistent departures and work on education to ensure the improvement on the BMPs that need it.

Streamside Management Zones

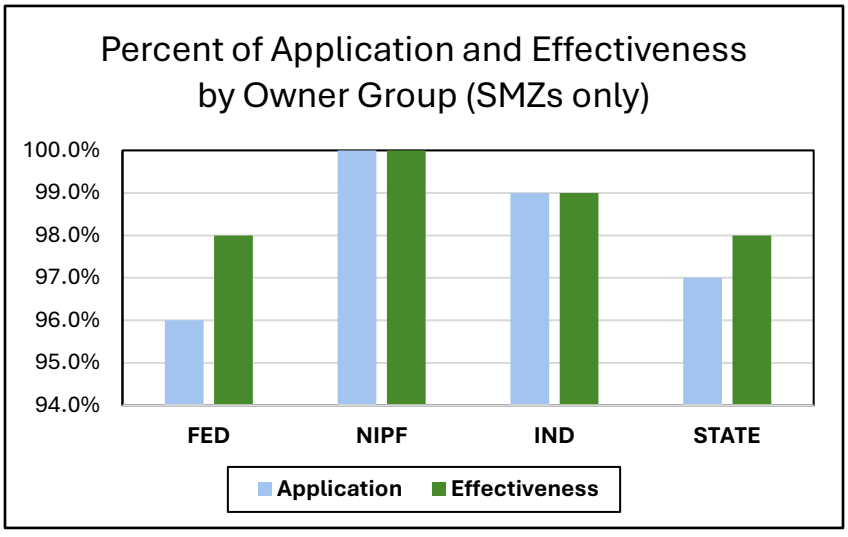
There is a different purpose in reviewing SMZ rules compared to BMP practices. Although they are both designed to protect water quality, the SMZ Law and Rules are regulated as a regulated activity. Conducting these field reviews allows for a non-regulatory look at SMZ rules compliance, while BMP is non-regulatory by design.

As in past years, BMPs listed for the SMZ were taken from the formal SMZ Rules adopted in 1993 and modified in 2006. The scoring was the same as the BMP five-part rating scale. As with the BMPs in general, these ratings did not constitute an investigation or a DNRC enforcement action, nor where/will they be used as a basis for future enforcement actions. The FRT evaluated departures based on their best professional judgment.

The SMZ law and rules were theoretically applicable to all 31 field review sites since they are regulations that pertain to timber harvesting. Certain activities would be prohibited regardless of whether harvest activities occur within or near the SMZ, such as side casting road material or the storage of hazardous material. Of the 31 sites, 24 sites received ratings. Only 5 sites had a harvest within the SMZ and therefore had the potential for impacts. Only one departure was noted within the 5 sites. A total of 192 SMZ evaluations were made including fish passage. SMZ were applied correctly 99.5% percent of the time which is a 2% improvement to the 2022 review cycle.

SMZ effectiveness was also very high with 99.5% for all ownerships combined. Of the 192 SMZ evaluations, 191 provided adequate protection (a 4 or 5 rating). The only impact was rated as major/temporary or minor/prolonged (2 rating). The departure/impact was regarded the side-casting of road material into a stream, lake, wetland, or other body of water during road maintenance. There were no ratings of major and prolonged impacts (1 rating). Figure 11 depicts the application adequacy and resulting effectiveness by ownership category.

Figure 6: SMZ Application and Effectiveness Rating of '4' and above.



Discussion

Overall, this BMP audit cycle looks similar to the past several cycles. BMP practices were properly applied over 96% of the time. Over 98% of the applied BMPs were shown to be effective in preventing sediment from reaching draws or streams. These percentages are the same as they were in 2022. This high level of compliance shows the strong commitment all ownership groups and the logging community have toward properly applying Montana's BMPs and practicing good forest management, particularly along rivers, streams, and wetlands. The logging community has a robust training program that emphasizes BMP and SMZ compliance and the on-the-ground loggers have taken the time to learn these lessons and diligently apply them in their daily work.

Table 5 shows the application impacts for the BMPs that had the most departures in 2024. Practice III.E.2* had the most application departures and while impacts were limited to one site, the impact was considered major and prolonged. This BMP shows that there was a lack of maintenance on culverts, ditches, cross drains etc. at some sites. BMP III.C.7 had fewer application departures (7) but the impacts were spread across six sites with three of the sites having a major/temporary or minor/prolonged impact as shown on Table 6. Adequate filtration zones provided by SMZ vegetation or other sediment-settling structures to prevent sediment from reaching a stream could be improved.

The last 34 years of BMP reviews provides an opportunity to see common themes with each cycle. The most problematic BMPs seem to alternate between road drainage and maintaining erosion control features, both of which are high-risk BMPs. This can be seen in the Figures 3, 4 and 5 which display impacts realized during the last 10 cycles. The 2024 cycle identified adequate filtrations zones with the most impacts. Most of these departures/impacts came from federal lands, because many of these 'legacy roads' were built decades ago prior to BMPs. The cost of completely upgrading or relocating some of these roads is a challenge to fit into today's budgets. Nonetheless, federal land management agencies adequately applied BMPs 95% of the time with a 98% effectiveness rate. Additionally, participation during field reviews by federal employees was very high which indicates a strong commitment to protect water quality while managing the forests.

With no historical of current departures on 13 BMPs (shown below), the over 'scores' presented could be seen as 'inflated'. An exercise to remove these BMPs was undertaken to determine the impact, however the change wasn't substantial, and the percentage of compliance only changed by 1% to 3%. This will be a recommended discussion topic at the next BMP Working Group meeting.

BMPs with no Departures from 1990-2024

Number	Practice Short Description
III.A.1a	Minimize the number of roads necessary
III.A.1b	Use existing roads unless aggravated erosion
III.A.3	Fit the road to the topography by locating roads on natural benched/contours

III.A.5a	Minimize the number of stream crossings
III.A.5b	Choose stable stream crossing sites.
III.D.9	Minimize sediment production from borrow pits and gravel sources
IV.A.2	Use the logging system that best fits the topography, soil, and season
IV.C.4	Scarify the soil only to the extent necessary to meet the resources management objectives
IV.C.6	Carry out scarification on steep slopes in a manner that minimizes erosion.
V.B.1a	Cross streams at right angles, if practical
V.B.2	Avoid unimproved stream crossings.
V.C.1	Minimize stream channel disturbances and related sediment problems during the construction of roads and installation of stream crossing structures.
V.C.6	Minimum cover for stream crossing culverts provided.

Third-party road and other use implications

Third-party road impacts were observed at several field sites. Third-party roads are roads not owned or directly controlled by the landowner being reviewed. Since the roads are not under the direct control of the participating landowner third-party roads are not rated in the field review process. To qualitatively monitor BMPs associated with third-party roads there is a location in section VII of the field review form (Appendix F) where teams can record observations regarding third-party roads.

Fish passage BMPs

The BMP working group has created a matrix for measuring the effectiveness of newly installed fish passage structures. The final process measures four separate parameters of the culvert installation. These are:

1. The installation accommodates bank-full width (the mean high-water level) of the stream;
2. Installations mimic the natural slope of the stream;
3. The installation retains substrates (gravels, cobbles, etc.) that are representative of the typical streambed for the stream in that location;
4. The installation retains water depth through the culvert that is consistent with the surrounding stream.

These four criteria are assessed on a less favorable – more favorable scale. An average 1-5 rating for the installation is developed based on these four ratings.

This year (2024) three sites were rated as applicable and were reviewed for fish passage. Of those sites two were on Federal lands and one was on State land. All the sites received a 4/4 rating.

Conclusions

The Conclusions will address the data collected and the analysis. The conclusions will address the objectives of the BMP field review.

Determine if BMPs are being applied to timber harvest operations.

When considering sites meeting site selection criteria, BMP is being applied correctly at a very high rate. This corresponds with past review cycles. Great care was taken in order not to disclose the location/identity of field review sites before the review to prevent activity that may alter the site from what it normally would have looked like. The necessary steps were taken to ensure the selection process was as random as possible. There were no sites reviewed where evidence of BMP application was not present. Informational handouts and local expertise from DNRC service, trust lands foresters, forestry consultants, loggers, MSU Extension Forestry, mill foresters, and knowledgeable landowners have all contributed to improving BMP application rates. It is very reasonable to conclude that the voluntary Forestry BMPs will continue to be the standard for timber harvest operations in Montana.

Evaluate the general effectiveness of BMPs in protecting soil and water resources.

Conclusions drawn from the field review results since the 2000 review cycle inclusive are very straightforward and consistent; when BMPs are applied correctly, they are very effective in protecting soil and water resources. This combined with the efforts of many loggers, landowners, agencies, and mills to go above and beyond the standards to minimize sediments and impacts has kept overall results high and has brought real improvements on the ground, where it counts. Even with some BMPs having some impact every year, BMPs are still protecting soil and water resources. Field review teams look at what the BMP was designed to protect. They ask questions such as “Is sediment entering the stream? Are roads rutted beyond typical usage patterns?” etc. The idea is to look at all the aspects of any BMP to determine if the practice is working or not and why. Teams note if it is a fault of the operation, outside factors, or the BMP itself. The BMP working group reviews the combined results and determines if any changes to the BMPs themselves need to be made.

Provide information on the implementation of the SMZ law and rules and assess the general effectiveness of SMZs in protecting water quality.

The 2024 field review data once again shows that the SMZ law and rules are being effectively and consistently applied across the state. This coincides with what we see in DNRC’s SMZ enforcement program. DNRC enforcement records continue to show that the SMZ law and rule violations across the state are few, the impacts associated with these violations are generally minor and that they can be effectively mitigated. As with previous review cycles, the 2024 field review data support the contention that the SMZ law and rules are highly effective in protecting water quality and streamside habitat and structure during timber harvest operations.

Provide information to focus future educational or study efforts by identifying subjects and geographic areas in need of further attention or investigation.

When a BMP is consistently being missed by loggers/landowners it is noted by the team leaders and is shown by the data collected. This information is factored into the agenda for the annual BMP/SMZ Workshops put on for the public and specific training may be devised by the DNRC to address the issue.

Provide information on the need to revise, clarify, or strengthen BMPs.

Opportunities to strengthen the BMPs are always assessed by the teams during "in-the-field" reviews. If a particular BMP appears to have gaps or needs additional language to properly respond to a new harvest methodology, that observation is reported back to DNRC who investigates and provides the information for the BMP Working Group to consider.

Recommendations for the BMP Working Group

I would recommend that the BMP working group focuses education and BMP trainings more on the BMPs that we have seen departures or impacts almost every year such as III.C.1, III.C.7, and III.E.2. Contractors and foresters continue to work for protections or improvements to water quality. If contractors/landowners know the practices needing improvement, they would then look for means to achieve better results and minimize impacts.

I would also recommend the BMP Working Group look at BMPs that have never seen a departure or an impact and explore options to discontinue or combine practices for future review cycles..

The last recommendation is to continue the hard work that forest professionals have put into BMP education and reviews; this work makes a difference and is the only way that Montana's BMP compliance will continue to excel.

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Appendix A

BEST MANAGEMENT PRACTICES FOR FORESTRY IN MONTANA

January 2006

Revised Version accepted by the BMP Working Group on April 29, 2010

* BMPs Not Monitored During Audits

I. DEFINITIONS

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

2. "Stream," as defined in 77-5-302(7), MCA, means a natural water course of perceptible extent that has a generally sandy or rocky bottom or definite banks and that confines and conducts continuously or intermittently flowing water.

3. "Streamside Management Zone (SMZ)" or "zone" as defined at 77-5-302(8), MCA means "the stream, lake, or other body of water and an adjacent area of varying width where management practices that might affect wildlife habitat or water quality, fish, or other aquatic resources need to be modified." The streamside management zone encompasses a strip at least 50 feet wide on each side of a stream, lake, or other body of water, measured from the ordinary high water mark, and extends beyond the high water mark to include wetlands and areas that provide additional protection in zones with steep slopes or erosive soils.

4. "Timber Harvesting" is the removal of any wood fiber from the forest for commercial purposes, and includes sawtimber, pulp, and biomass materials such as slash, tops, branches, needles and leaves.

5. "Wetlands" mean those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands include marshes, swamps, bogs, and similar areas.

6. Adjacent wetlands are wetlands within or adjoining the SMZ boundary. They are regulated under the SMZ law.

7. Isolated wetlands lie within the area of operation, outside of the SMZ boundary, and are not regulated under the SMZ law.

II. STREAMSIDE MANAGEMENT

The Streamside Management Law (77-5-301 through 307 MCA) provides minimum regulatory standards for forest practices in streamside management zones (SMZ). The "Montana Guide to the Streamside Management Zone & Rules" is an excellent information source describing management opportunities and limitations within SMZs.

III. ROADS

A. Planning and Location

1. Minimize the number of roads constructed in a watershed through comprehensive road planning, recognizing intermingled ownership and foreseeable future uses. Use existing roads, unless use of such roads would cause or aggravate an erosion problem.

2. Review available information and consult with professionals 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, seeps, wetlands, wet meadows, and natural drainage channels.

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

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

B. Design

1. Properly design roads and drainage facilities 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 engineering standards can be alleviated through proper 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 to minimize disruption of natural drainage patterns. Vary road grades to reduce concentrated flow in road drainage ditches, culverts, and on fill slopes and road surfaces.

C. **Road Drainage** Road Drainage is defined as all applied mechanisms for managing water in a non-stream crossing setting, road surface drainage, and overland flow; ditch relief, cross drains and drain dips)

1. Provide adequate drainage from the surface of all permanent and temporary roads. Use outsloped, insloped or crowned roads, and install proper drainage features. Space road drainage features so peak flow on road surfaces or in ditches will not exceed capacity.

    a. Outsloped roads provide a 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 can be met.

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

    c. Design and install road surface drainage features at adequate spacing to control erosion; steeper gradients require more frequent drainage features. Properly constructed drain dips can be an economical method of road surface drainage. Construct drain dips deep enough into the subgrade so that traffic will not obliterate them.

2. Design all ephemeral draw culverts with adequate length to allow for road fill width. Minimum culvert size is 15 inch. Install culverts to prevent erosion of fill, seepage and failure as described in V.C.4 and maintain cover for culverts as described in V.C.6.

3. Design all relief culverts with adequate length to allow for road fill width. Protect the inflow end of all relief culverts from plugging and armor if in erodible soil. When necessary construct catch basins with stable side slopes. Unless water flows from two directions, skew ditch relief culverts 20 to 30 degrees toward the inflow from the ditch to help maintain proper function.

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

5. Provide energy dissipaters (rock piles, slash, log chunks, etc.) where necessary to reduce erosion at outlet of drainage features. Crossdrains, culverts, water bars, dips, and other drainage structures should not discharge onto erodible soils or fill slopes without outfall protection.

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

7. Route road drainage through adequate filtration zones or other sediment-settling structures to ensure sediment doesn't reach surface water. Install road drainage features above stream crossings to route discharge into filtration zones before entering a stream.

D. **<u>Construction</u>** (see also Section IV on stream crossings)

1. Keep slope stabilization, erosion and sediment control work current with road construction. Install drainage features as part of the construction process, ensuring that drainage structures are fully functional. Complete or stabilize road sections within same operating season.*

2. Stabilize erodible, exposed soils by seeding, compacting, riprapping, benching, mulching, or other suitable means.

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 (example, slash filter windrow). When done concurrently with road construction, this is one method that can effectively control sediment movement, and it can also provide an economical way of disposing of roadway slash. Limit the height, width and length of "slash

filter windrows" so wildlife movement is not impeded. Sediment fabric fences or other methods may be used if effective.

4. Minimize earthmoving 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 to prevent sloughing and other subsequent erosion.

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 fill.
7. Consider road surfacing 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 adequate drainage and safety; avoid disturbing stable road surfaces. Prior to reconstruction of existing roads within the SMZ, refer to the SMZ law. Consider abandoning existing roads when their use would aggravate erosion.

E. <u>Maintenance</u>

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

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

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

4. When plowing snow, 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 sidecasting in locations where erosion will carry materials into a stream.*

6. Avoid using roads during wet periods if such use would likely damage the road drainage features. Consider gates, barricades or signs to limit use of roads during spring break up or other wet periods.

7. Upon completion of seasonal operations, ensure that drainage features are fully functional. The road surface should be crowned, outsloped, insloped, or water-barred. Remove berms from the outside edge where runoff is channeled.*

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.

IV. TIMBER HARVESTING, AND SITE PREPARATION

A. Harvest Design

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

    a. Soils and erosion hazard identification.
    b. Rainfall.
    c. Topography.
    d. Silvicultural objectives.
    e. Critical components (aspect, water courses, landform, etc.).
    f. Habitat types.
    g. Potential effects on water quality and beneficial water uses.
    h. Watershed condition and cumulative effects of multiple timber management activities on water yield and sediment production.
    i. Wildlife habitat.
    j. Biodiversity and native species.
    k. Long-term site productivity.
    l. Organic matter removal and retention tradeoffs.

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. Using designated skid trails is one means of limiting site disturbance and soil compaction. Use -existing skid trails where practical, located appropriately, and consistent with other management objectives. Consider the potential for erosion and possible alternative yarding systems prior to planning tractor skidding on steep or unstable slopes.*

5. Locate skid trails to avoid concentrating runoff and provide breaks in grade. Locate skid trails and landings away from natural drainage systems and divert runoff to stable areas. Limit the grade of constructed skid trails on geologically unstable, saturated, highly erosive, or easily compacted soils to a maximum of 30%. Use mitigating measures, such as water bars and grass seeding, to reduce erosion on skid trails.

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

B. <u>Other Harvesting Activities</u>

1. Tractor skid where 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 operation can be conducted without causing excessive erosion. Avoid skidding with the blade lowered. Suspend leading ends of logs during skidding whenever possible.

2. Avoid operation of wheeled or tracked equipment within isolated wetlands, except when the ground is frozen (see Section VI on winter logging).

3. Use directional felling or alternative skidding systems for harvest operations in isolated wetlands.*

4. For each landing, provide and maintain a drainage system to control the dispersal of water and to prevent sediment from entering streams.

7. Insure adequate drainage on skid trails to prevent erosion. On gentle slopes with slight disturbance, a light ground cover of slash, mulch or seed may be

sufficient. Appropriate spacing between water bars is dependent on the soil type and slope of the skid trails. Timely implementation is important.

8. When existing vegetation is inadequate to prevent accelerated erosion, apply seed or construct water bars before the next growing season on skid trails, landings and fire trails. A light ground cover of slash or mulch will retard erosion.*

C. Slash Treatment and Site Preparation

1. Rapid reforestation of harvested areas is encouraged to reestablish protective vegetation.*

2. When treating or removing slash, care should be taken to preserve the surface soil horizon by using appropriate techniques and equipment. Avoid use of dozers with angle blades.

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 resource management objectives. Some 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 preferred means for site preparation, especially on slopes greater than 40%.

7. Remove all logging machinery debris to proper disposal site.*

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

V. STREAM CROSSINGS

A. Legal Requirements

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.

   Before beginning such a project, the operator must submit a permit application to the conservation district indicating the location, description, and project plans. The evaluation generally includes on-site review, and the permitting process may take up to 60 days.

2. 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.

3. A short-term exemption (3a authorization) from water quality standards is necessary unless waived by the Department of Fish, Wildlife and Parks as a condition of a 310 or 124 permit. Contact the Department of Environmental Quality in Helena at 444-2406 for additional information.

B. **Design Considerations** (Note: 310 permit required for perennial streams)

1. Cross streams at right angles to the main channel if practical. Adjust the road grade to avoid the concentration of road drainage to stream crossings. Direct drainage flows away from the stream crossing site or into an adequate filter.

2. Avoid unimproved stream crossings. Depending on location, culverts, bridges and stable/reinforced fords may be used.

C. **Installation of Stream Crossings** (Note: 310 permit required for perennial streams)

1. Minimize stream channel disturbances and related sediment problems during construction of road and installation of stream crossing structures. Do not place erodible material into stream channels. Remove stockpiled material from high water zones. Locate temporary construction bypass roads in locations where the stream course will have minimal disturbance. Time construction activities to protect fisheries and water quality.

2. Design stream-crossings for adequate passage of fish (if present) with minimum impact on water quality. When using culverts to cross small streams, install those culverts to conform to the natural stream bed and slope on all perennial streams and on intermittent streams that support fish or that provides seasonal fish passage. Ensure fish movement is not impeded. Place culverts slightly below normal stream grade to avoid outfall barriers.
3. Do not alter stream channels upstream from culverts, unless necessary to protect fill or to prevent culvert blockage. On stream crossings, design for, at a minimum, the 25-year frequency runoff. Consider oversized pipe when debris loading may pose problems. Ensure sizing provides adequate length to allow for depth of road fill.

4. Install stream-crossing culverts 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 feasible.

5. Consider dewatering stream crossing sites during culvert installation.*

6. Maintain a 1-foot minimum cover for stream-crossing culverts 15 to 36 inches in diameter, and a cover of one-third diameter for larger culverts, to prevent crushing by traffic.

7. Use culverts with a minimum diameter of 15 inches for permanent stream crossings.*

D. Existing Stream Crossing

1. Ensure stream crossing culverts have adequate length to allow for road fill width and are maintained to preserve their hydrologic capacity. To prevent erosion of fill, provide or maintain armoring at inlet and/or outlet with rock or other suitable material where feasible. Maintain fill over culvert as described in V.C. 6.

VI. Winter Logging

A. General

1. Consider snow-road construction and winter harvesting in isolated wetlands and other areas with high water tables or soil erosion and compaction hazards.*

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

3. Consult with operators experienced in winter logging techniques.*

B. Road Construction and Harvesting Considerations

1. For road systems across areas of poor bearing capacity, 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 culvert locations. During and after logging, make sure that all culverts and ditches are open and functional.*

3. Use compacted snow for road beds in unroaded, wet or sensitive sites. Construct snow roads for single-entry harvests or for temporary roads.*

4. In wet, unfrozen soil areas, use tractors or skidders to compact the snow for skid road locations only when adequate snow depth exists. Avoid steeper areas where frozen skid trails may be subject to erosion the next spring.*

5. Return the following summer and build erosion barriers on any trails that are steep enough to erode.*

VII. HAZARDOUS SUBSTANCES

A. General

1. Know and comply with regulations governing the storage, handling, application (including licensing of applicators), and disposal of hazardous substances. Follow all label instructions.

2. Develop a contingency plan for hazardous substance spills, including cleanup procedures and notification of the State Department of Environmental Quality.*

B. Pesticides and Herbicides

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

2. 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 B

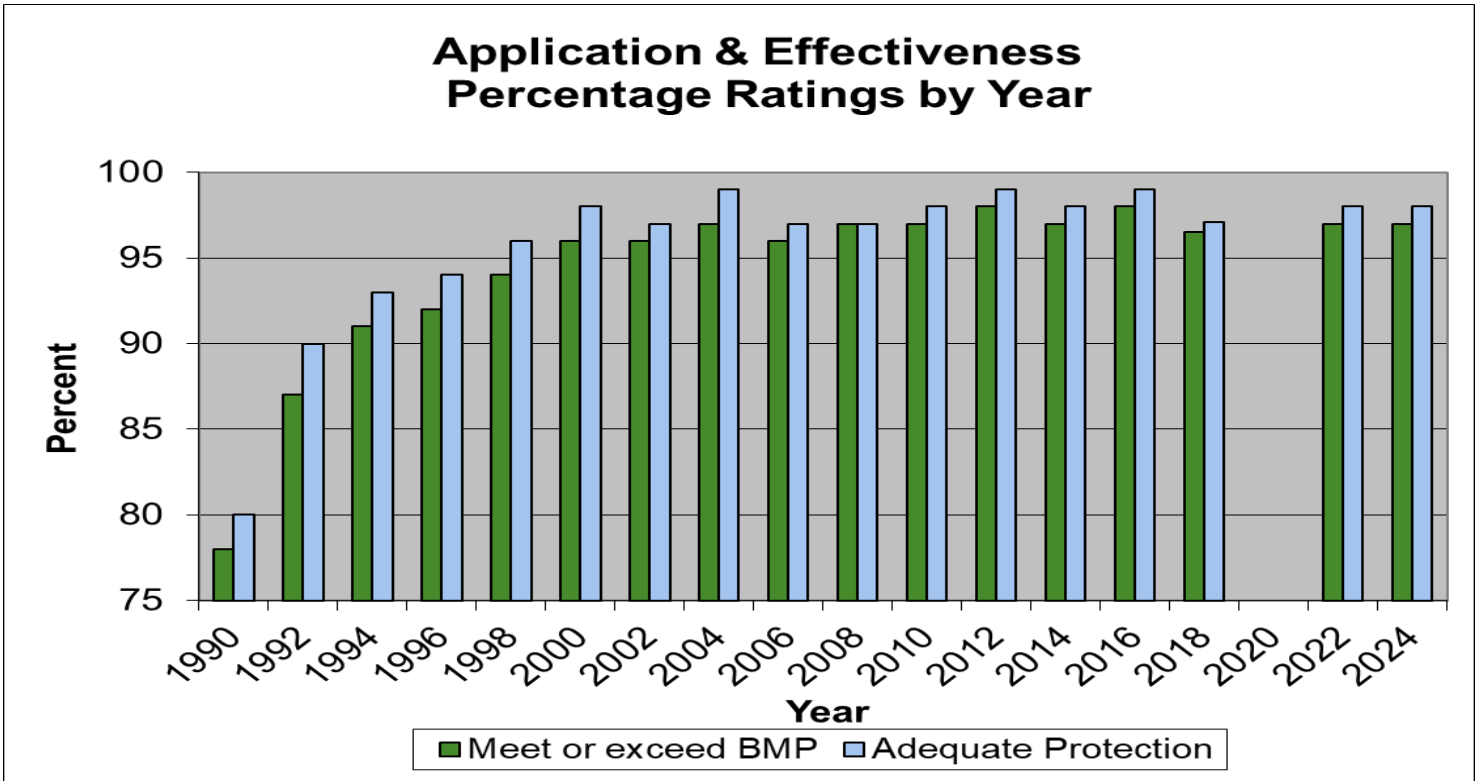
2024 BMP Field Reviews Sites by Ownership

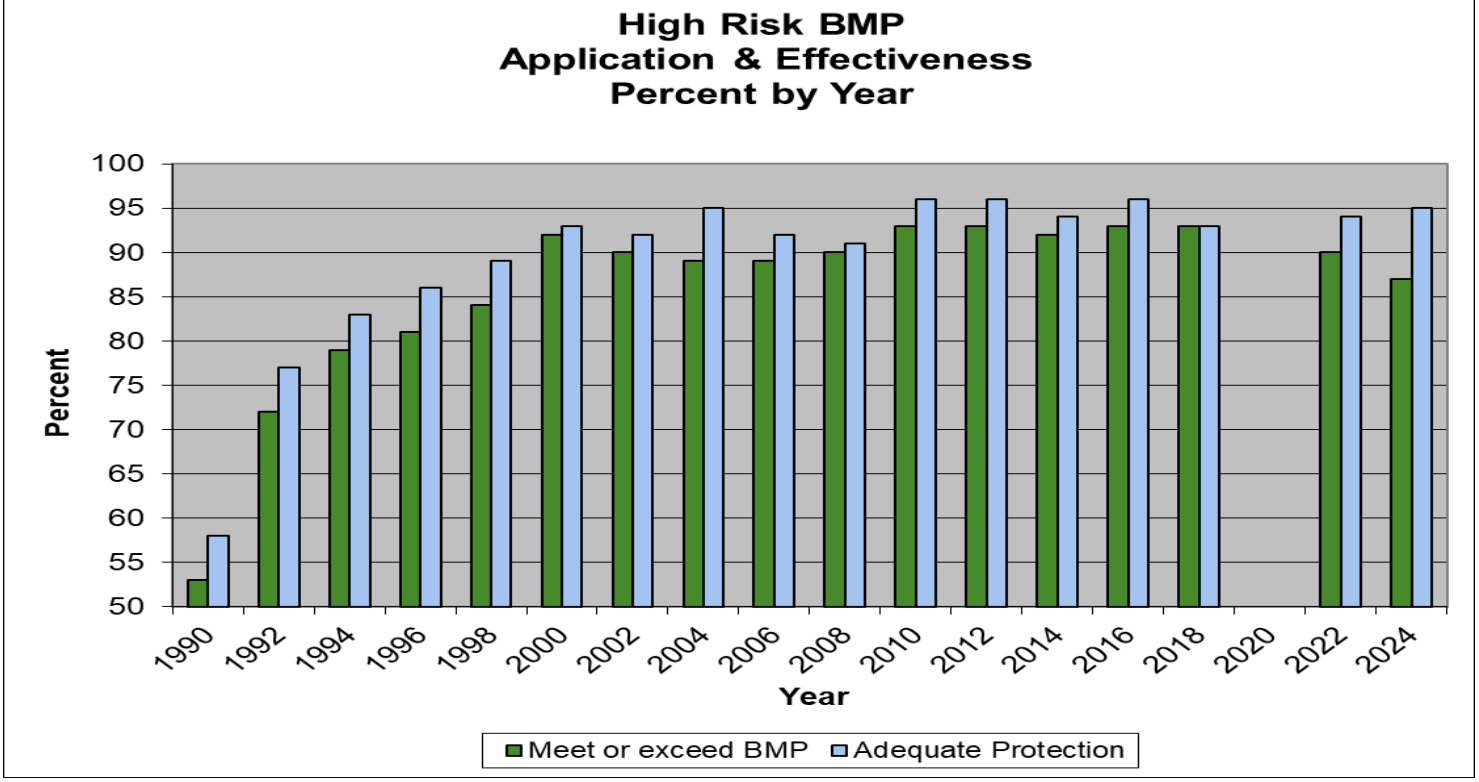
Site #	Site Name	County	Owner
FED-2	North Bridgers*	Gallatin	USFS-GNF
FED-3	Brock Out Salvage*	Powell	BLM-Missoula
FED-4	Purple Marten*	Sanders	USFS-KNF
FED-5	Hall Wood*	Mineral	USFS-LNF
FED-6	Pintler Face III Salv*	Beaverhead/Deer lodge	USFS-B-DNF
FED-7	Swamp Rat*	Flathead	USFS-FNF
FED-8	Kootenai Faceoff*	Lincoln	USFS-KNF
FED-9	BMO ReOffer Tractor*	Gallatin	USFS-GNF
FED-10	Red Rocks II Salv*	Jefferson	USFS-B-DNF
FED-11	How Now	Lake	USFS-FNF
FED-12	Gtr Dunn	Lincoln	USFS-KNF
FED-13	GNA Meadow	Lincoln	USFS-KNF
FED-14	GNA Weed Lake South	Lake	USFS-FNF
FED-15	Border Raid	Lincoln	USFS-KNF
FED-17A	Johnson Camp	Mineral	USFS-LNF
NIPF-1	Bigfork*	Flathead	Private
NIPF-2	Smith Lake*	Flathead	Private
NIPF-5	Clark Fork	Sanders	Private
NIPF-6	Landers Fork	Lewis and Clark	Private
NIPF-7A	Trout Creek	Sanders	Private
IND-1	Horn Property SW2022*	Flathead	FH Stoltze
IND-2	Young Cr Line Shovel*	Sanders	Green Diamond Resource Co.
IND-3	Spruced Up*	Flathead	Green Diamond Resource Co.
IND-4	Cody Rodeo	Lincoln	Stimson Lumber Co
IND-5	Yellowjacket	Flathead	Flathead Ridge Ranch
ST-1	Browns Meadow*	Flathead	DNRC-Kalispell
ST-2	Beetlejuice*	Missoula	Lubrecht Experimental Forest
ST-3	South of Blanchard*	Missoula	DNRC-Clearwater
ST-4	High Lion*	Lake	DNRC-Swan
ST-5	Ashley Schoolhouse Blowdown	Flathead	DNRC-Kalispell
ST-6	Cow Creek Salvage	Rosebud	DNRC-Eastern Land Office

** Indicates a high-risk sale*

Appendix C

Application and Effectiveness Percentage Ratings by Year





Appendix D

BMP FIELD REVIEW SITE INFORMATION FORM

ALL OWNERSHIPS – 2024 CYCLE

A) Please completely fill in this sheet for each site that meets minimum criteria.

B) Maps submitted should highlight or otherwise identify new road construction and/or reconstruction and Streamside Management Zones.

C) All references to streams and Streamside Management Zones (SMZ) are based on the MT SMZ Law and 2006 Rules update, see instructions.

Sale Name: _____

Is this a subdivision/isolated portion of a larger sale? Yes No

Salvage Sale: Yes No Landowner Type: Federal NIPF Industry State

Landowner/Agency Representative: _____ Phone: _____

MHRA Attachment: Yes No MHRA Agreement Number: _____

Logging Contractor: _____ Phone: _____

Legal Description: Sec. _____ TWN _____ RNG _____

Total Acres Harvested: _____ Volume/Acre removed: _____ MBF/Ac

Primary Drainage(s): _____ County: _____

****

New Road Construction (Since 2019): Yes No Miles ¬¬¬¬_____ Yr. Complete _____

Road Reconstruction/Deconstruction: Yes No Miles ¬¬¬¬_____ Yr. Complete _____

Month/Year Harvest Conducted: From: _____ To: _____

Slash Disposal Complete: Yes No Type of Disposal: Burn Grind Bury Scatter

****

New Stream Crossing Culvert Installation: Yes No Number of crossings: _____

Is new crossing on a fish bearing stream: Yes No

Pre-Existing Stream Crossings on Access Road System: Yes No

Stream Within 200 Feet of a Harvest Unit: Yes No

Are SMZ's (SMZ Law Definition) Delineated: Yes No

Riparian (SMZ) Harvest: Yes No

Stream(s) Name and Stream Class (SMZ Law): _____

_____

Appendix E

2024 BMP FIELD REVIEW TEAM MEMBERS

Name	Affiliation	Team
Cory Anderson	USFS	NW
Mike Anderson	DNRC	W
Rex Anderson	Sun Mountain Logging	CE
Nick Aschenwald	DNRC	NW
Wayne (Skip) Barndt	*retired USFS*	W
Chad Blanchard	DNRC	NW
Kenneth Breidinger	MFWP	NW
Kyle Carpenter	DNRC	W
Nate Cole	DNRC	NW
Madison Colyer	Hill Conservation District	NW
Caleb Deitz	FRR	NW
Beth Dodson (team leader)	UM	NW/W/CE
Paul Donnellon	USFS	NW
Andy Efta	USFS	W
Joshua Harris	DNRC	NW
Shane Hendrickson	BIA Flathead Agency	W
Kyle Johnson	BLM	W
Kyle Harrington	DNRC	C/E
Dale Kerkvliet	*retired BIA*	W/CE
Dave Krueger	Sun Mountain Lumber	CE
Ella Lunny	DEQ	NW/W/CE
Kathleen Marks	BLM	W
James Mackey	Stimson Lumber	NW/W
Doug Mote	Mote Lumber	CE
Vince Pacific	USFS	CE
Jeremy Rank	DNRC	NW
Hannah Riedl	DEQ	NW/W/CE
Leo Rosenthal	MFWP	NW
Trevor Selch	FWP	CE
Chris Steen	USFS	NW
Tye Sundt	Weyerhaeuser	NW
Adam Switalski	Clark Fork Coalition	W
Marc Vessar	DNRC	NW/W/C/E
Jack White	DNRC	NW
Cameron Wohlschlegel	FH Stoltze Land & Lumber	NW
Quintin Woirhaye	Sun Mountain Lumber	CE

Appendix F

BMP Field Review Site Form

DS-49
Rev 6/06

BMP FIELD AUDITS
SITE INFORMATION

Site Number: _____ Meets Selection Criteria: Y/N _____
High Hazard: Y/N _____: Riparian _____Matrix____

Site Name: _____

Owner(s): _____

Legal Description: _____ County: _____

Primary Drainage: _____ Month/Year Harvested: _____

Stream Within 200 Ft.? Y / N Name: _____ Bankfull Width: _____

Unit Size: _____ Volume Removed: _____

Road Construction: _____ Length: _____

Road Reconstruction: _____ Length: _____

Slash Disposal Complete: _____ Method: _____

Logging Method: _____

Slope: 0-5%_____; 5-20%_____; 20-40%_____; 40%+_____

Parent Material: _____

Soil Erodibility: High Medium Low

Harvest in SMZ: Y / N

Stream Class: _____

Comments:

FIELD AUDIT

Date:

Team Leader/Recorder:

Team Members:

Observers Present:

Rating Guide

APPLICATION
5—Operation Exceeds Requirements Of Bmp
4—Operation Meets Requirements Of Bmp
3—Minor Departure From Bmp
2—Major Departure From Bmp
1—Gross Neglect Of Bmp

EFFECTIVENESS
5—Improved Protection Of Soil And Water Resources Over Pre-Project Condition
4—Adequate Protection Of Soil And Water Resources
3—Minor And Temporary Impacts On Soil & Water Resources
2—Major And Temporary Or Minor And Prolonged Impacts On Soil And Water Resources.
1—Major And Prolonged Impacts On Soil And Water Resources.

DEFINITIONS (BY EXAMPLE)
Adequate—Small amount of material eroded; Material does not reach draws, channels, or floodplain.
Minor—Erosion and delivery of material to draws but not stream.
Major—Erosion and subsequent delivery of sediment to stream or annual floodplain.
Temporary—Impacts lasting one year or less; no more than one runoff season.
Prolonged—Impacts lasting more than one year.

NR – Not Reviewed NA – Not Applicable

MONTANA FOREST PRACTICES REVIEW WORKSHEET

BMPs Applicable to:
+ New Road Construction
# Existing Roads
➢ Reconstruction

	RECOMMENDED BEST MANAGEMENT PRACTICES	APPLICABLE TO SITE (Y/N)	APPLICATION	EFFECTIVENESS	COMMENTS
SECTION III—ROADS					
	ROAD PLANNING & LOCATION SECTION III. A.				
➢+	1a. Minimize number of roads necessary.				
#	1b. Use existing roads unless aggravated erosion.				
+	3. Avoid long, sustained, steep road grades.				
+	4. Locations avoid high-hazard sites (i.e., wet areas and unstable slopes).				
+	5a. Minimize number of stream crossings. Number .				
+	5b. Choose stable stream crossing sites.				
	ROAD DESIGN SECTION III.B.				
➢+	2. Design roads to minimum standard necessary to accommodate anticipated uses.				
+	4. Vary road grade to reduce concentrated drainage.				
	ROAD DRAINAGE – SECTION III. C.				
+➢#	1. Provide adequate road surface drainage for all roads.				
+➢	2. Design ephemeral draw culverts with adequate length and size and to prevent erosion of fill. Minimum size 15" maintain cover.				
+➢#	3. Design all relief culverts with adequate length and appropriate skew. Protect inflow end from erosion. Catch basins where appropriate.				
+➢#	4. Install culverts at original gradient, otherwise rock armour or anchor downspouts.				
+➢#	5. Provide energy dissipaters at drainage structure outlets where needed.				
+➢#	7. Route road drainage through adequate filtration zones before entering a stream.				

MONTANA FOREST PRACTICES REVIEW WORKSHEET

BMPs Applicable to:
+ New Road Construction
# Existing Roads
➢ Reconstruction

	CONSTRUCTION/RECONSTRUCTION SECTION III. D.				
+➢	2. Stabilise erodible soils (i.e., seeding, benching, mulching).				
+➢	3. Provide effective sediment control on erodible fill slopes (ex. Slash filter windrow).				
+➢	5. Cut and fill slopes at stable angles. Slope ratio: _____.				
+➢	6. Avoid incorporating woody debris in road fill.				
+➢	8. Excess materials (waste) placed in locations that avoid entering stream.				
+➢	9. Sediment from borrow pits and gravel pits minimized.				
➢	10. Reconstruct only to the extent necessary to provide adequate drainage and safety.				
	ROAD MAINTENANCE SECTION III. E.				
+➢#	1. Grade roads as necessary to maintain drainage.				
+➢#	2. Maintain erosion control features (dips, ditches and culverts functional).				
#	3. Avoid cutting the toe of cut slopes.				
+➢#	6. Avoid use of roads during wet periods and spring breakup.				
+➢#	8. Abandoned roads in condition to provided adequate drainage without further maintenance.				
	SECTION IV – TIMBER HARVESTING				
	HARVEST DESIGN SECTION IV. A.				
	2. Suitable logging system for topography, soil type and season of operation.				
	5. Design and locate skid trails to avoid concentrating runoff.				
	6. Suitable location, size, and number of landings.				

MONTANA FOREST PRACTICES REVIEW WORKSHEET

BMPs Applicable to:
+ New Road Construction
# Existing Roads
➢ Reconstruction

	OTHER HARVESTING ACTIVITIES SECTION IV. B.				
1a.	Skidding operations minimizes soil compaction and displacement.				
1b.	Avoid tractor skidding on unstable slopes and slopes that exceed 40% unless not causing excessive erosion.				
2.	Avoid operation of equipment within isolated wetlands.				
4.	Adequate drainage for landing.				
5.	Adequate drainage for skid trails.				
	SLASH TREATMENT AND SITE PREPARATION SECTION IV. C.				
2.	Treat slash so as to preserve the surface soil horizon.				
4.	Scarify only to the extent necessary to meet resource management objective.				
5.	Activities limited to frozen or dry conditions to minimize soil compaction and displacement.				
6.	Equipment operations on suitable slopes only.				
8.	Limit water quality impact of prescribed fire.				
	SECTION V – STREAM CROSSINGS				
	LEGAL REQUIREMENTS SECTION V. A.				
➢+ 1.	Proper permits for stream crossings.				
	DESIGN CONSIDERATIONS SECTION V. B.				
➢+ 1a.	Cross streams at right angles, if practical.				
➢+ 1b.	Direct road drainage away from stream crossing site.				
➢+ 2.	Avoid unimproved stream crossings.				

MONTANA FOREST PRACTICES REVIEW WORKSHEET

BMPs Applicable to:

\+ New Road Construction

\# Existing Roads

➢ Reconstruction

INSTALLATION OF STREAM CROSSINGS SECTION V. C.					
➢+ 1.	Minimize stream channel disturbance.				
➢+ 2.	Stream crossing culverts conform to natural streamed and slope.				
➢+ 3.	Proper sizing for stream crossing structures.				
➢+ 4.	Prevent erosion of stream crossing culverts and bridge fills (i.e., armor inlet and outlet).				
➢+ 6.	Minimum cover for stream crossing culverts provided.				
	EXISTING STREAM CROSSING SECTION V. D.				
# 1.	Culverts are maintained to preserve their hydrologic capacity. Adequate length to allow for road fill width. Rock armoring. Maintain fill over culvert.				
SECTION VII – HAZARDOUS SUBSTANCE					
	GENERAL				
1.	Know and comply with regulations governing the storage, handling, etc. of hazardous substances.				
#	Project included road improvements to existing road system that reduced overall sediment delivery to streams.	Y/N Comment(s):			
+➢#	Road system contains third party road systems.	Y/N Comment(s)			

ADDITIONAL COMMENTS:

MONTANA FOREST PRACTICES REVIEW WORKSHEET

BMPs Applicable to:

\+ New Road Construction

\# Existing Roads

➢ Reconstruction

STREAMSIDE MANAGEMENT ZONE SITE INFORMATION				
RECOMMENDED BEST MANAGEMENT PRACTICES				COMMENTS
1. Adequate SMZ width maintained, avg. width .				
2. Exclusion of broadcast burning in SMZ.				
3. SMZ retention tree requirements met. (# of trees, representative of pre-harvest stand, favor bank-edge and leaning trees, shrubs and sub merchantable).				
4. Exclusion of equipment operation in SMZ except on established roads.				
5. Exclude construction of roads in the SMZ except when necessary to cross a Stream or wetland.				
6. Exclusion of road fill material deposited in SMZ except as needed to construct crossings.				
7. Exclusion of side-casting of road material into a stream, lake, wetland or other body of water during road maintenance.				
8. Exclusion of slash in streams, lakes or other bodies of water.				
9. Exclude the handling, storage, application of disposal of hazardous or toxic materials in the SMZ in a manner that pollutes or causes damage or injury.				
10. Pre-approved alternative practices				
11. DNRC approved site specific alternative practices.				

ADDITIONAL COMMENTS:

Appendix G

FISH PASSAGE FIELD REVIEW FORM

Date:

Field Review Site Name: _____

Field Review Site Number: _____

INSTALLATION OF STREAM CROSSINGS	
SECTION V. C.	**COMMENTS**
2. Design stream-crossings for adequate passage of fish (if present) and ensure fish passage is not impeded.	
** Stream crossing type and/or structure modification (fords, baffles, bridges).	
a. Structure width accommodates bankfull width. Bankfull width _____ Culvert width _____ Constriction ratio _____	
b. Structure slope mimics upstream and downstream slope Channel slope _____ Culvert slope _____ Difference _____	
c. Structure retains substrates representative of the upstream and	

downstream reaches and/or design material. % of culvert bottom with substrate _____				
d. Structure retains water depth representative of upstream and downstream reaches. Channel water depth _____ Culvert water depth_____ Difference _____				
FISH PASSAGE SCORING TOTAL	**Application to Site (Y/N)**	**Application**	**Effectiveness**	**OVERALL COMMENTS**
Design stream-crossings for adequate passage of fish (if present) with minimum impact on water quality. Ensure fish passage is not impeded				

Application and Effectiveness Guidelines for the Fish Passage BMP Field Reviews

Application Rating

Design Criteria	Rating Guidelines (Examples)	Application Rating
V.c.2.a. - structure <u>width</u> accommodates bankfull width	W_{strct} meets W_{bkf} (Constriction Ratio >= 0.9[1]	MORE FAVORABLE ↓ LESS FAVORABLE
	W_{strct} slightly constricts W_{bkf} (Constriction Ratio 0.7 – 0.89)[2]	
	W_{bkf} obviously not taken into consideration (Constriction Ratio <0.5)	
V.c.2.b. - Structure <u>slope</u> mimics upstream and downstream slope	Structure placed at stream grade (within ± 1%)[2]	MORE FAVORABLE ↓ LESS FAVORABLE
	Structure placed steeper/shallower than stream (± 1% - 3%)	
	Structure slope obviously not taken into consideration (> ± 5%)	
	Structure retaining material throughout the structure. (90-100%)[2]	MORE FAVORABLE

V.c.2.c. - Structure retains <u>substrates</u> representative of the upstream and downstream reaches and/or design material	Structure retaining material throughout a portion of structure (10-90%)	↓
	No substrate being retained and substrate not taken into consideration.	LESS FAVORABLE
V.c.2.d. - Structure retains <u>water depth</u> representative of upstream and downstream reaches	Water depth representative of stream channel[2]	MORE FAVORABLE
	Water depth slightly altered compared to stream channel (<50% change in depth)	↓
	No surface water found within structure or excessive surface water	LESS FAVORABLE MORE FAVORABLE

1 - Constriction Ratio = structure width divided by bankfull width (ex. 5' culvert/10' stream width = 0.5)

2 – Representative of the natural stream channel outside the zone of crossing-structure influence.

Application and Effectiveness Guidelines for

Fish Passage BMP Field Reviews

Effectiveness Rating

Fish Passage	Rating Guidelines (Examples)	Rating
Design stream-crossings for adequate passage of fish (if present) with minimum impact on water quality. Ensure fish passage is not impeded	Not applicable or possibly in the case of a replacement	5 - Improved Passage
	No passage concerns for local species at any time of year	4 - Adequate Passage
	Passage concerns due to minor application departures	3 - Minor and temporary Passage Impediment
	Passage concerns due to major application departures	2 - Major and temporary Passage Impediment
	Passage concerns for both low and high water flow	1 - Major and Prolonged Passage Impediment

Field Review procedures and measurements:

All measurements will be taken outside the zone of structure influence. (Except for culvert slope)

- Tape measurements of structure width and bankfull width.
    - Calculate constriction ratios (structure width/bankfull width)
        - Minimum of three measurements upstream and/or downstream at riffle sections, at bankfull width.
- Measurement of stream and structure slope (Clinometer)
    - Measure stream slope upstream and downstream of structure
        - Minimum of three measurements upstream and downstream, from riffle to riffle, measured in same direction.
- Substrate will be visually estimated, minimally
    - Keeping mind it is a human tendency to overestimate substrate size.
        - Consider substrates within 200 feet below and above structure. Estimate proportions of various size classes.
- Water depth will be measured with a wading staff
        - Minimum of three measurements upstream and downstream, measured at thalweg depth at bankfull width measure locations.

Detailed comments are required in order to elaborate and/or defend the effectiveness rating.

Appendix H

BMP FIELD REVIEW RATING FLOW CHART