



# Colorado Forestry Best Management Practices

Forest Stewardship Guidelines for Water Quality Protection

2018 Field Monitoring Report  
Compiled August 2020

Richard M. Edwards, CF, and Erik Castello



# Table of Contents

Executive Summary .....	1
Acknowledgments .....	1
Introduction .....	2
Monitoring Objectives .....	4
Monitoring Process .....	4
Monitoring Procedure .....	6
Field Monitoring Results .....	8
Recommendations .....	11
Summary .....	11
Appendix A .....	A-1
2018 Field Monitoring Data and Rating Guide Criteria	
Appendix B .....	B-1
Site Information and Ranking Criteria Field Form	

**COVER:** *A helicopter and log loader work in tandem to remove trees from an area in the Taylor Canyon affected by mountain pine beetle. Phase I of the Wilder-Highland sanitation salvage operation near Gunnison encompassed 104 acres and involves multiple partners. Using established Best Management Practices helps ensure such forestry work results in minimal impact to surrounding terrain.*

**BACK COVER:** *The Wilder-Highlands National Forest Foundation project began in June 2020 on private lands northeast of Gunnison. Lodgepole pine, dramatically affected by the mountain pine beetle in the Taylor Canyon area, are being removed as part of a CSFS project to help the forest return to its once-thriving condition.*

Photos: Sam Pankratz, CSFS



# Executive Summary

Water is a valuable commodity in Colorado that requires protection. To proactively safeguard water quality from nonpoint source pollution, Colorado has implemented Best Management Practices (BMPs) for forestry activities. BMPs are a set of water-quality protection measures and activities that provide guidance in forest management planning, road and stream crossing construction, Streamside Management Zones (SMZs), timber harvesting, pesticide and fertilizer application, and fire management. Compliance with BMPs is voluntary and administered within a non-regulatory framework.

In October 2018, an interdisciplinary team visited six timber harvest and/or fuel treatment sites in west-central Colorado to quantify BMP application and effectiveness. Sites included federal, private or state-owned lands, each evaluated according to written criteria in the field monitoring rating guide (Appendix A). The information and results presented are based on the observational data obtained from each site.

The 2018 monitoring showed the application of BMPs was met or exceeded 95 percent of the time. Minor departures from the BMP applications occurred 5 percent of the time, and there were no major departures or gross neglect of any practices. BMPs were found to be effective in providing adequate or improved resource condition 100 percent of the time. In addition, no minor and temporary, minor and prolonged, major and temporary, or major and prolonged effects were observed.

Activities on state lands scored the highest in BMP application, having met or exceeded BMP standards 100 percent of the time. Federal lands met or exceeded BMPs 95 percent of the time, with minor departures making up the remaining 5 percent. Private-land management activities met or exceeded BMP standards 92 percent of the time, with minor departures making up the remaining 8 percent of the observed practices.

BMP effectiveness on federal forestlands was adequate or improved 100 percent of the time, while effectiveness on state forest sites was adequate 100 percent of the time. Private forest sites scored 99 percent in adequately protecting or improving conditions. Minor and temporary effects were observed on the other 1 percent of the practices observed.

Based on findings of this assessment, the monitoring team made several recommendations to address specific questions or concerns related to SMZs and ongoing monitoring and suggested new BMP field handbook additions and revisions. Additional outreach and training should be continued to our intended BMP implementers: forestry and logging operators, landowners, and managers.

## Acknowledgments

As part of continuing efforts to protect water quality by monitoring Best Management Practices (BMPs) during forestry and silviculture operations, the Colorado State Forest Service (CSFS) organized the 2018 BMP Field Monitoring. An ongoing effort, the BMP Field Monitoring Program began in 2008. In 2011, a follow-up audit report documented the effectiveness of several BMPs on four of the six original sites. The last four field monitoring trips returned to a biennial schedule from 2012 through 2018.

### **The following individuals served on the 2018 field monitoring team:**

- Tony Auciello, Jefferson County Open Space
- Erik Castello, Colorado State Forest Service
- Casey Cooley, Colorado Parks and Wildlife
- Rich Edwards, Colorado State Forest Service
- Bud Halldorson, Colorado State Tree Farm Committee
- Peter Monahan, U.S. Environmental Protection Agency
- Molly Pitts, Colorado Timber Industry Association
- Chuck Rhoades, U.S. Forest Service

The CSFS is grateful to these individuals, agencies and organizations for contributing to the 2018 BMP Field Monitoring. Although confidentiality of forestry/logging contractors and landowners is strictly maintained, the CSFS also values their assistance and cooperation.

Editing assistance was provided by Dr. Chuck Rhoades, Rocky Mountain Research Station, U.S. Forest Service, and Diana Selby, CSFS Forest Planning and Implementation Division. Figures and photos for this report were provided by the CSFS

Communications and Communities Division, Sam Pankratz, CSFS, and Rich Edwards, CSFS. Editing and design assistance was provided by the CSFS Communications and Communities Division.

## Introduction

The headwaters of all of Colorado's major rivers originate in the state's forested lands, where the forests help produce high-quality water. Across the state, at least 80 percent of the population relies on this for their domestic water supply. These waters also provide for irrigation, livestock, recreation and industrial uses and support important fisheries in the western United States. Therefore, it is essential that landowners and managers take the necessary measures to maintain water quality.

The U.S. Environmental Protection Agency (EPA) classifies forestry and silviculture activities as potential sources of nonpoint source (NPS) pollution under the Clean Water Act ([www.epa.gov/owow/nps/qa.html](http://www.epa.gov/owow/nps/qa.html)). The EPA defines nonpoint source pollution as follows:

***“Nonpoint source (NPS) pollution, unlike pollution from industrial and sewage treatment plants, comes from many diffuse sources. Nonpoint source pollution is caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters, and even our underground sources of drinking water.”***

Timber is harvested from federal, private and state forested lands in Colorado. Though caution is taken during harvesting operations, standard practices can impact land during logging projects. Excessive sediment entering waterways, often from roads and/or skid trails, is the most common NPS pollution from forestry and silvicultural activities. Common timber harvesting practices include construction and use of forest roads, skid trails and landings. Such activities remove vegetative cover and can result in soil compaction, thus reducing precipitation infiltration rates. If poorly planned, located or constructed, these structures can intercept other surface waters, concentrating surface flow and transporting sediment into receiving waters. However, these potential

sources of pollution are preventable if forestry and timber harvest Best Management Practices (BMPs) are implemented.

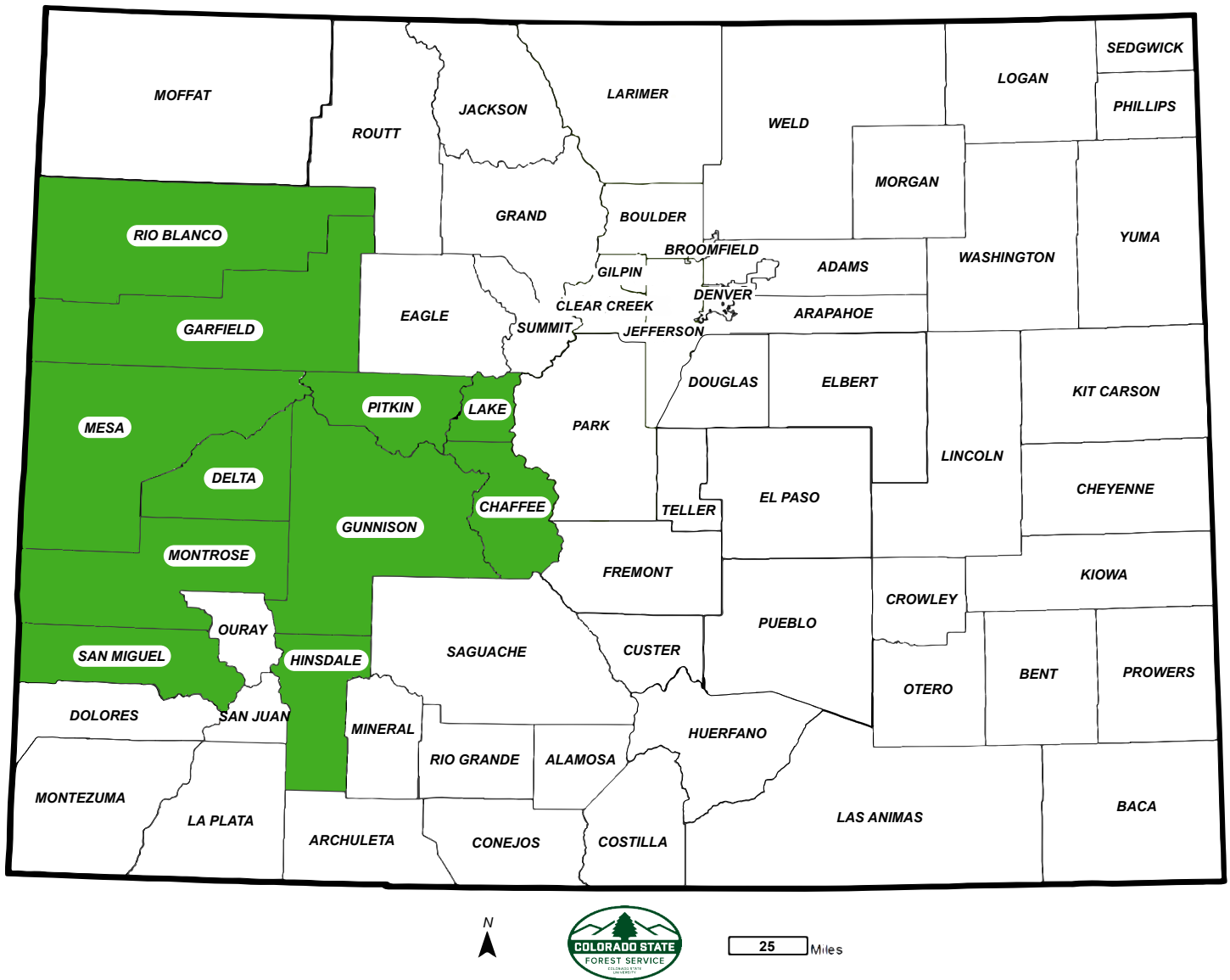
Forestry BMPs are a set of water-quality protection measures and guidelines. BMPs provide direction on planning, roads, Streamside Management Zones (SMZs), timber harvesting, hazardous substances, stream crossings and fire management. Implementation of BMPs can limit or avoid NPS pollution. Compliance with forestry BMPs is voluntary in Colorado and is administered within a non-regulatory framework. BMP implementation monitoring serves as an acceptable surrogate for water-quality monitoring, which is a more quantitative, time-consuming and expensive approach.

The Colorado Timber Industry Association (CTIA) and the Colorado State Forest Service (CSFS) developed “Colorado Forest Stewardship Guidelines to Protect Water Quality, Best Management Practices for Colorado” in 1998. The CTIA, the CSFS, the Colorado NPS Task Force and the U.S. EPA provided funding for this publication, which is now out of print.

Following the inaugural 2008 BMP field audit, the CSFS received funding from the Colorado Water Quality Control Division of the Colorado Department of Public Health and Environment to update forestry BMPs for Colorado. The resulting booklet, “Forestry Best Management Practices to Protect Water Quality in Colorado 2010,” is available in print at all CSFS locations throughout the state and online at: <http://static.colostate.edu/client-files/csfs/pdfs/ForestryBMP-CO-2010.pdf>.

In addition, the “Colorado Forestry Best Management Practices, Forest Stewardship Guidelines for Water Quality Protection” 2016 field monitoring report is available at: [https://csfs.colostate.edu/media/sites/22/2019/12/308991\\_BMP\\_Audit\\_Oct2019-www.pdf](https://csfs.colostate.edu/media/sites/22/2019/12/308991_BMP_Audit_Oct2019-www.pdf).

The Colorado Forestry BMP Monitoring process is designed to survey BMP compliance across the state. The 2010 CSFS “Colorado Statewide Forest Resource Assessment” identified 24.4 million acres of forest and woodlands, with nearly 68 percent in federal ownership. The report notes, “Approximately 186,000 private landowners own 30 percent, or 7.1 million acres, of the state's forested landscapes.”



**FIGURE 1:** Counties that participated in the 2018 Colorado Forestry BMPs Field Monitoring

Colorado’s NPS 2012 Management Plan states, “Nearly 37 percent of the total surface land and water of the state is federally owned, largely in headwaters areas.” However, much of the timber harvesting takes place on private lands. Consequently, BMP monitoring sites on fuel reduction/timber sales were selected from each major landowner group in the state: federal, private and state.

Using the field monitoring rating guide criteria (Appendix A), each site was evaluated on key components of the timber sale, including planning, roads, SMZs, timber harvesting, hazardous substances, stream crossings and fire management. BMP compliance was evaluated on the basis of two criteria for each practice – application and

effectiveness. The application rating indicated the degree of compliance with suggested BMP methodology, and the effectiveness rating established whether the practice, as applied, was sufficient to achieve the intended protection of water resources.

The 2018 Colorado forestry BMP monitoring was the fifth assessment for the state. The BMP field monitoring was partially funded through a USDA Forest Service State and Private Forestry grant. The monitoring was conducted on six timber harvest sites (three private, two federal and one state land) by a team of professionals in engineering, forestry, geology, hydrology, soil science and wildlife from federal, state and private sectors. The forest products industry and landowners also were represented on the team.



**FIGURE 2:** The sale administrator briefs the monitoring team and answers questions prior to a site visit.  
 Photo: R.M. Edwards, CSFS

## Monitoring Objectives

The 2018 monitoring team evaluated voluntary compliance to BMP standards detailed in the 2010 publication “Forestry BMPs to Protect Water Quality in Colorado”. The overall goal was to proactively monitor the implementation of the state forestry BMPs and evaluate the effectiveness of each.

### The 2018 monitoring report objectives include:

1. Monitoring the effects of silviculture activities on water quality.
2. Monitoring the avoidance and protection of wetland soil and water resources during harvest/treatment and road construction.
3. Monitoring road-building effects (temporary/permanent roads/trails) in riparian areas.
4. Evaluating the level of fuels treatment/timber harvest planning and design needed to maintain or improve the hydrographic character of timberlands; protecting soils from erosion and streams from sedimentation during runoff periods.
5. Evaluating the protection of SMZs under the BMPs.

## Monitoring Process

### Site Selection

The CSFS selected sites from a non-randomized pool of fuel treatments/timber sales on federal, private and state forestland. To establish equal representation of each of these landowner groups and to focus on sales/treatments with the greatest potential to affect water quality, the following baseline criteria were used to select sales/treatments from a list of potential sites:

1. Sale/treatment has the potential to affect water quality.
2. Minimum of 1,000 board feet/or 1 Mbf (2 cunits / or 2 CCF) per acre were harvested/masticated/removed.
3. Sale/treatment was completed within the last two years.
4. Sale/treatment was potentially located in Chaffee, Delta, Garfield, Gunnison, Hinsdale, Lake, Mesa, Montrose, Ouray, Pitkin, Rio Blanco or San Miguel counties.

The minimum requirement of 1Mbf harvested per acre was used to ensure that sales/treatments with only marginal potential to affect water quality were not selected. In addition, many of the sales/treatments in the state occur in areas where little or no live water or other sensitive hydrologic resources are present.

While many BMPs are applicable to such sales/treatments, the monitoring focused on areas with



**FIGURE 3 TOP:**  
*The monitoring team inspects skid trails and the Streamside Management Zone (SMZ).*

**FIGURE 4 BELOW:**  
*The monitoring team works on reaching consensus on BMP application and effectiveness ratings.*

*Photos: R.M. Edwards, CSFS*



### **Overview of Selected Sites**

In order to complete the monitoring within one week, the six fuel treatments/timber sales sites chosen as subjects were located within the geographical boundaries of four CSFS field offices (Figure 1).

Site nominations were solicited from three USDA Forest Service supervisor offices, four CSFS field offices and the CTIA Executive Committee and local CTIA membership list. One private site was eliminated prior to the monitoring site visits due to a lack of surface water or wetlands. This was used as a “practice” site for the monitoring team’s new members. Another recently treated site on private land (site #3) was selected as a replacement before the first day of the monitoring because it satisfied all baseline criteria.

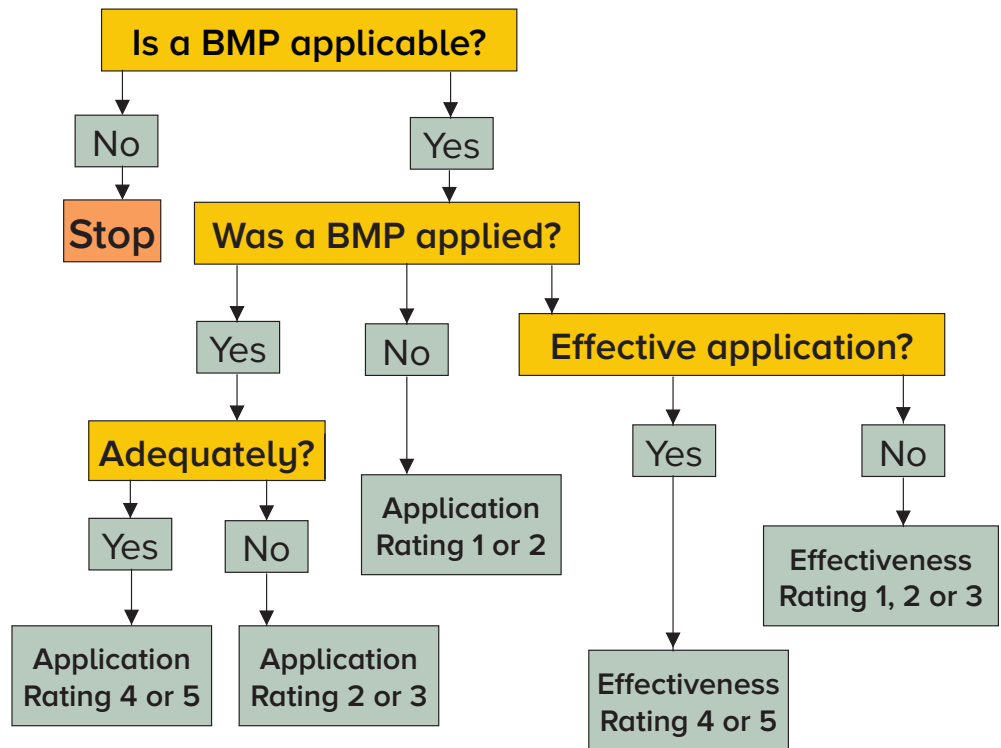
To maintain confidentiality and privacy, ownership and specific locations of the selected sites are not identified in this report. Only the type of land classification is disclosed (i.e., federal, private or state). Different forestry contractors/logging companies (also not identified) worked at each site.

potential to affect water quality. This selection method created bias in the results, as monitoring took place where sales/treatments were likely to affect water resources with departures from the BMPs.

The location criteria consist of counties within four CSFS field office boundaries (Grand Junction, Gunnison, Montrose and Salida). Previous monitoring has been conducted in other areas of the state. The intent is to cover all forested areas in Colorado.

# Monitoring Procedure

Field monitoring was conducted over five days, and the monitoring team spent approximately 2-3 hours on each fuel treatment/timber sale site. Six of the eight team members had participated in at least one other BMP monitoring effort and/or federal BMP consistency review in one or more states over the last 10 years. This allowed for significant cross-training of newer team members and helped improve understanding of rating criteria and applicability of the guide.



**FIGURE 5:** Colorado BMP Monitoring Ranking System

Personnel directly associated with each fuel treatment/timber sale (either compliance forester or sale administrator) briefed the monitoring team on details of the treatment/harvest at each location. Areas of particular importance, such as SMZs, roads and landing areas near the riparian corridor, were identified, as were sale administration details. The monitoring team was given an opportunity to inspect the area.

No effort was made to inspect each acre of the harvested area or each mile of road; rather, the monitoring focused on the critical portions of the timber sale where proper BMP application was most important. The information presented in the report is based on the observational data obtained from each site.

After inspecting these areas, the monitoring team reconvened to evaluate the applicable BMPs for each site through observation and discussion. After reaching consensus on applicability, an on-site team leader recorded the application and effectiveness rating for each of the BMP items. A different member of the monitoring team acted as team leader at each location. The BMP Field Monitoring Data and Rating Guide Criteria are attached (Appendix A).

The rating process conducted for each BMP begins with establishing whether the BMP in question is applicable to the fuels management/harvest activities

under consideration (Figure 5). For example, not all fuel treatment/harvest sites require the construction of temporary roads. In these cases, the BMPs that pertain to temporary roads are not applicable. Once the monitoring team establishes that a given BMP is applicable, the application rating for the BMP is determined, based on written criteria (Table 1).

The monitoring team then evaluated the BMP effectiveness, which determined whether the BMP was successful in protecting water quality, again based on written criteria (Table 2).

While visiting monitoring sites, the team kept notes about how the “Forestry Best Management Practices to Protect Water Quality in Colorado 2010” might be improved and how future monitoring processes might be conducted. Those findings are included in the recommendations portion of this report.

## Limitations of the Monitoring Process

Practicality, time and resources limit evaluation of each fuels treatment/timber sale for continual compliance with BMPs from project initiation to completion. Instead, the monitoring process is designed to act as a “spot check,” which is limited to areas of the sale/ treatment site that have the greatest potential to affect water quality. The timing of the monitoring in the life



**TABLE 1: BMP Application Ratings and Criteria**

Rating	Criteria
5	Operation exceeds requirements of BMP.
4	Operation meets the standard requirement of BMP.
3	Minor departure from BMP.
2	Major departure from BMP.
1	Gross neglect of BMP.

**TABLE 2: BMP Effectiveness Ratings and Criteria**

Rating	Criteria
5	Improves protection of soil and water resources over pre-project conditions.
4	Adequate protection of soil and water resources.
3	Minor and temporary impact to soil and water resources.
2	Major and temporary or minor and prolonged impacts to soil and water resources.
1	Major and prolonged impacts to soil and water resources.

### Definition of Effectiveness Terms

**Adequate:** Small amount of material eroded, but does not reach draws, channels or floodplain

**Minor:** Some material erodes and is delivered to stream or annual floodplain

**Major:** Material erodes and is delivered to stream or annual floodplain

**Temporary:** Impacts last less than one season

**Prolonged:** Impacts last more than one year

**TABLE 3: Colorado Forestry BMP 2018 Field Monitoring Application Results, by Land Ownership**

Ownership	Exceeded BMP	Met BMP Standard	Minor Departure	Major Departure	Gross Neglect	Total
Federal	2	74	4	0	0	80
	2%	93%	5%	0%	0%	100%
Private	4	77	7	0	0	88
	4%	88%	8%	0%	0%	100%
State	1	37	0	0	0	38
	3%	97%	0%	0%	0%	100%
Total	7	188	11	0	0	206
	4%	91%	5%	0%	0%	100%

**TABLE 4: Colorado Forestry BMP 2018 Field Monitoring Effectiveness Results, by Land Ownership**

Ownership	Improved Conditions	Adequate Protection	Minor and Temporary	Minor/ Prolonged or Major/ Temporary	Major and Prolonged	Total
Federal	2	78	0	0	0	80
	3%	97%	0%	0%	0%	100%
Private	3	84	1	0	0	88
	4%	95%	1%	0%	0%	100%
State	0	38	0	0	0	38
	0%	100%	0%	0%	0%	100%
Total	5	200	1	0	0	206
	3%	97%	< 1%	0%	0%	100%

**TABLE 5: Comparison of BMP Application and Effectiveness Results, by Year Monitored (2008-2018)**

Application	Exceeded BMP	Met BMP Standard	Minor Departure	Major Departure	Gross Neglect
2008	3%	84%	11%	3%	0%
2012	2%	84%	10%	4%	0%
2014	2%	80%	13%	3%	3%
2016	5%	79%	10%	6%	0%
2018	4%	91%	5%	0%	0%

Effectiveness	Improved Conditions	Adequate Protection	Minor and Temporary	Minor/ Prolonged or Major/ Temporary	Major and Prolonged
2008	1%	81%	15%	3%	0%
2012	2%	86%	12%	0%	0%
2014	1%	83%	16%	0%	0%
2016	2%	88%	4%	6%	0%
2018	3%	97%	0%	0%	0%

of the sale/treatment also is limited, in that monitoring cannot simultaneously examine the pre-sale/treatment, ongoing and post-sale/treatment activities to which BMPs apply. Evaluation of BMPs relating to time was based on implementation to date, where final results were not yet realized. For example, sites where grass seed mixtures have been applied but germination has not yet occurred generally were assumed to germinate successfully.

## Field Monitoring Results

In 2018, BMPs were met or exceeded 95 percent of the time (195 out of 206 rated items – Table 3). Minor departures occurred 5 percent of the time, mostly on private lands. No major departures or gross neglect of any BMP was found on federal, private or state project sites.

State sales/treatments scored the highest application rates, having met or exceeded the BMP standard 100 percent of the time. It should be noted that this is the second time state land classifications have met or exceeded all BMP applications rated within its class.

BMPs were effective at providing adequate protection or improved water resource conditions an average of approximately 100 percent over all ownerships (Table 4). BMP effectiveness on federal and state forestlands occurred 100 percent of the time on both land classifications. Private lands were slightly lower, with 99 percent experiencing adequate or improved conditions. Minor and temporary effects were observed 1 percent for private lands. Minor and prolonged, major and temporary, and major and prolonged effects were not observed on any forestland during this monitoring period. Again, it should be noted that this is the first time a given federal land classification has met or exceeded all BMP effectiveness ratings within its class. This is also the second time a given state site met or exceeded all BMP application rates and adequately protected or improved conditions on all BMP effectiveness ratings.

In general, BMPs were properly applied and effective in 2018. Table 5 illustrates the 2018 BMP application and effectiveness rating results for all landowners, compared to the results of the previous 2008, 2012, 2014 and 2016 monitoring periods. The application results remained relatively consistent between the first two periods. In comparison, minor departures

and gross neglect of BMP application increased in the 2014 results and returned to pre-2014 levels in 2016, although major departures increased to their highest level ever in 2016 and decreased to their lowest level ever in 2018.

In addition, the effectiveness results improved slightly between 2008 and 2012, with more BMPs providing adequate or improved conditions. However, effectiveness results decreased again in 2014, increased in 2016 and returned to their highest level ever in 2018. It should be noted that minor and prolonged and major and temporary effects decreased to zero in both 2012 and 2014 and then increased to their highest level ever in 2016, decreasing back to zero again in 2018. Again, no major and prolonged effects were observed in 2018.

Based on the 2018 forestry BMP monitoring, the following observations were made. The order parallels the BMP guidance document.

### *Planning*

#### *Sanitary guidelines for the construction of camps*

Camping was not an issue on any of the monitored sites. Sale operators and their employees were mostly locally based and only stayed on two of the federal sites. The BMP application standard was met and BMP effectiveness adequately protected on both sites.

### *Roads*

#### *Road design and location*

Existing roads were used on most of the sites wherever possible. Sites with newly constructed or reconstructed roads met BMP requirements and adequately protected soil and water resources. All of the departures from BMPs occurred on existing roads in or near SMZs, were minor in nature and occurred on one federal and two private sites. The federal site improved protection of soil and water resources by decommissioning an existing legacy road.

#### *Road construction/reconstruction*

Where road construction/reconstruction occurred, proper techniques were used to provide for adequate drainage and safety. In general, earth-moving activities were minimized during wet periods; slope stabilization, erosion and sediment control work were kept as

current as possible; erodible soils were stabilized; and woody material was not incorporated into road fills. On one of the federal sites, cut-and-fill slopes were kept at stable angles, erodible soils were stabilized, existing rooted trees and shrubs were left at the toe of the fill slopes, cut and fills were balanced and the side-casting of road material was excluded from water features.

### **Road drainage**

Road drainage was fairly uniform across the sites visited. The federal and state sites were rated adequate overall with no BMP departures, while protecting soil resources. Private sites were rated adequate to fair in both application and effectiveness of BMPs. One private site contained a minor drainage structure outlet issue in both BMP application and effectiveness. This particular private site did not provide energy dissipaters where needed, resulting in a minor BMP application departure along with a minor and temporary impact to soil and water resources.

### **Road maintenance**

Most of the sites met the requirements of the maintenance BMPs and provided for adequate protection of soil and water resources. This included maintaining erosion control features, grading roads only as necessary to maintain drainage, avoiding cutting the toe of the cut slopes, excluding side-cast materials from streams and leaving any abandoned roads in sufficient condition to provide adequate drainage. A minor BMP application departure was noted on one of the federal sites with regard to avoiding the use of roads during wet periods.

In addition, the federal site that eliminated a legacy road (as mentioned in the road design and location section above) was able to exceed the BMP application requirements while improving protection of soil and water resources by providing adequate drainage without need for further maintenance. To note, this highest possible BMP rating was a first for a federal site to date in 10 years of monitoring.

### **Streamside Management Zone (SMZ) delineation**

As in years past, the highest proportion of departures in BMP application occurred in the SMZ category. It should be noted, however, all soil and water resources were adequately protected and all departures were minor in rating magnitude. All federal and state sites met or exceeded all application ratings, with

associated adequately or improved protection of soil and water resources effectiveness ratings.

One of the federal sites scored the highest in this aspect, with the application of one practice exceeding the BMP requirements. This consisted of a perennial stream course with an SMZ measure of 100-plus feet in width (range: 105-135 feet). All sites managed to identify adequate SMZ widths, maintain or provide sufficient ground cover, exclude equipment operation in the SMZ, retain adequate tree cover and exclude slash from entering the stream course.

Two of the private sites had two minor BMP application departures both involving improperly marked SMZs and exclusion of burning within the SMZ. The effectiveness was similarly rated for both sites as a minor and temporary impact to soil and water resources.

### **Stream crossings and stream bank protection**

None of the monitoring sites contained applicable BMPs of this category.

### **Installation of stream crossings**

None of the monitoring sites contained applicable BMPs of this category.

## **Timber Harvesting, Thinning, Slash Treatment and Revegetation**

### **Harvest design**

All harvest sites used suitable location, size and number of landings, while also designing and locating skid trails to minimize soil disturbance and using existing areas wherever possible. One federal site, three private sites and the state site used suitable logging systems for topography, soil type and season of operation. Only one of the federal sites had a minor departure in applying the BMP for utilizing a suitable logging system with a limited operating season and no use of winter logging.

One private site exceeded BMP application requirements and improved protection of soil and water resources over the pre-project conditions for both a suitable logging system and skid trail design and location. This high rating was primarily due to the fact a very low impact helicopter logging system was used on the site. No other operation to date has received two perfect BMP ratings for the same site.

### ***Other harvesting activities***

One federal site, all three private sites and the state site met all application BMP requirements and adequately protected or improved all effectiveness BMP requirements. These included equipment operation that minimizes soil compaction and displacement; avoidance of equipment operation on unstable, wet or easily compacted soil, or on slopes that exceed 40 percent; and appropriate drainage control for both landings and skid trails.

The other federal site only had one minor BMP application departure in not providing for appropriate drainage control for landings. However, associated BMP effectiveness was deemed to be adequately protecting the soil and water resource.

### ***Slash treatment and site preparation***

Scarification was not used on any of the sites. All sites treated their slash in order to minimize disturbance of the surface soil horizon and left adequate slash material to slow runoff, return soil nutrients and provide shade for seedlings. In addition, activities were limited to frozen or dry conditions to minimize soil compaction and displacement.

### ***Revegetation of disturbed areas***

Grass seeding was used in many areas, and seeding rates were observed to be generally adequate. All sites where this BMP was applicable met or exceeded BMP application and effectiveness requirements. The one private site that exceeded the application criteria involved a very low impact helicopter logging system that resulted in very low residual tree stand damage and skidding impacts.

### ***Pesticides, Fertilizers and Chemicals***

Fertilizers were not used on any of the sites that were visited. All sites had spill contingency plans and properly designated sites selected for servicing and refueling to prevent contamination of waters from accidental spills. Pesticides were used on all three private sites and properly applied and monitored. One private site used pesticides supplied and monitored by the landowner and, therefore, effectiveness was rated by the team as improving the protection of the soil and water resource.

### ***Fire Management***

#### ***Protection of soil and water from the effects of prescribed burning***

Prescribed fire was utilized on all sites except for one private site. BMP application requirements were met and effectiveness soil and water impacts were adequately protected on all five of these sites.

#### ***Stabilization of fire suppression-related work damage***

This BMP was not applicable on any of the sites because no suppression-related activities occurred.

#### ***Emergency rehabilitation of watersheds impacted by wildfires***

This BMP was not applicable on any of the sites because no emergency rehabilitation of watershed activities occurred.

# Recommendations

During the monitoring, several BMPs required clarification or expansion, prompting the following recommendations for future BMP guide documents and monitoring:

- Many of the BMP application departures and effectiveness impacts in 2008 through 2018 occurred in the SMZ. Although this biennial monitoring period has the best overall performance since the forestry BMP program was implemented, there are still some minor application departures that continue to be noted. As recommended in the past, it appears that additional, continued, focused outreach and training on this subject is required for forestry and logging operators, landowners and managers.
- More specific guidance is needed for forestry and logging operators, landowners and managers on stream types (i.e., perennial, intermittent and ephemeral), and operational guidance should be provided to address acceptable activities within the SMZ.
- A separate “Fire Management” category should be added to the BMP field handbook when it is updated. These changes will better facilitate handbook use during the monitoring and allow for easier general reference.
- Supplemental guidance should be provided for SMZ width, especially with regards to slope in subsequent BMP versions. Other states have more specific guidance for width, depending on side-slope gradient.
- The monitoring team needs guidance on spatial limits of BMPs to be inspected within a given site on the form. Some confusion has occurred over the years regarding whether the team needed to be concerned with areas outside of site boundaries (e.g., between site boundary and county road).
- Language can be added regarding use of existing landing and skid-trail areas to minimize soil disturbance within updated BMP field handbook
- Additional outreach and training to forestry and logging operators, landowners and managers on all forestry-related BMPs should be continued.
- Forestry BMPs should continue to be available to various users through online resources and meetings.

## Summary

Monitoring in 2018 shows that application of BMPs in forestry and logging operations in Colorado occurred at a rate of 95 percent, with an effectiveness rate of 100 percent. The monitoring team is quite pleased with these levels. Although a slight overall decline was noted from the second to the third monitoring periods (2012 to 2014), the 2016 application ratings again increased, while effectiveness ratings were the highest recorded to date. The 2018 application and effectiveness ratings have again increased and are the highest to date since initial program inception. The team has made several recommendations and

believes the application and effectiveness rates can be maintained or further improved.

With continuing statewide issues such as insects and diseases, an increase in destructive and relatively high-intensity wildfires and an improving forest products industry infrastructure, the number of acres being harvested and/or treated will increase. It is essential to continually evaluate and adjust BMPs as new issues and information are presented. The BMP monitoring will serve as the information source for updating state BMPs.





# Appendix A

## 2018 Forestry BMP Field Monitoring Data and Rating Guide Criteria

Land Ownership/ Timber Sale Identification	Federal Site #1		Federal Site #2		Private Site #1		Private Site #2		Private Site #3		State Site #1	
	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness
<b>PLANNING</b>												
<b>Sanitary Guidelines for the Construction of Camps</b>												
Adequate sewer and soil waste considerations on site to protect water quality if camps are present.	4	4	4	4	NA	NA	NA	NA	NA	NA	NA	NA
<b>ROADS</b>												
<b>Road Design and Location</b>												
Design roads to minimum standard necessary to accommodate anticipated use and equipment.	4	4	NA	NA	NA	NA	NA	NA	NA	NA	4	4
Minimize number of roads necessary.	4	4	NA	NA	NA	NA	NA	NA	NA	NA	4	4
Use existing roads unless aggravated erosion will be likely.	4	4	4	4	4	4	4	4	4	4	NA	NA
Avoid long, sustained, steep road grades.	4	4	NA	NA	NA	NA	NA	NA	NA	NA	4	4
Locations avoid high-hazard sites (i.e., wet areas and unstable slopes).	4	4	NA	NA	NA	NA	NA	NA	NA	NA	4	4
Minimize number of stream crossings.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Choose stable stream crossing sites.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Locate roads to provide access to suitable log landing areas.	4	4	NA	NA	NA	NA	NA	NA	NA	NA	4	4
Locate roads a safe distance from streams when they are parallel.	4	4	NA	NA	NA	NA	NA	NA	NA	NA	4	4
Keep roads outside of Stream Management Zones.	3	5	4	4	NA	NA	3	4	4	4	4	4



Land Ownership/ Timber Sale Identification	Federal Site #1		Federal Site #2		Private Site #1		Private Site #2		Private Site #3		State Site #1	
	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness
<b>Road Construction/ Reconstruction</b>												
Construct/reconstruct only to the extent necessary to provide adequate drainage and safety.	4	4	4	4	NA	NA	NA	NA	4	4	4	4
Minimize earth moving activities when soils appear excessively wet.	4	4	4	4	NA	NA	NA	NA	4	4	4	4
Keep slope stabilization, erosion, sediment control work as current as possible, including "slash filter windrows."	4	4	NA	NA	NA	NA	NA	NA	NA	NA	4	4
Cut and fill slopes at stable angles.	4	4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Stabilize erodible soils (i.e., seeding, benching, mulching).	4	4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Avoid incorporating woody material in road fill.	4	4	NA	NA	NA	NA	NA	NA	NA	NA	4	4
Leave existing rooted trees and shrubs at the toe of fill slope.	4	4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Balance cuts and fills or use full bench construction.	4	4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment from borrow pits and gravel pits minimized.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Excess materials placed in location that avoids entering stream.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Avoid excavation into ground water.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Exclusion of side-casting of road material into a stream, lake, wetland or other body of water.	4	4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Road Drainage</b>												
Vary road grade to reduce concentrated drainage.	4	4	NA	NA	NA	NA	NA	NA	NA	NA	4	4
Provide adequate road surface drainage for all roads.	4	4	4	4	4	4	4	4	4	4	4	4
Space road drainage outlets so peak runoff will not exceed capacity of drainage outlets.	4	4	NA	NA	NA	NA	NA	NA	NA	NA	4	4

Land Ownership/ Timber Sale Identification	Federal Site #1		Federal Site #2		Private Site #1		Private Site #2		Private Site #3		State Site #1	
	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness
For in-sloped roads, plan ditch gradients of generally greater than 2%, but no more than 8%.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Construct drain dips deep enough into the subgrade so traffic will not obliterate them.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Install culverts at original gradient, otherwise rock armor or anchor downspouts.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Design all relief culverts with adequate length and appropriate skew. Protect inflow end from erosion. Catch basins where appropriate.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Provide energy dissipaters at drainage structure outlets where needed.	NA	NA	NA	NA	4	4	3	3	4	4	4	4
Route road drainage through adequate filtration zones before entering a stream.	4	4	4	4	4	4	4	4	4	4	4	4
<b>Road Maintenance</b>	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness
Maintain erosion control features (dips, ditches and culverts functional).	4	4	4	4	4	4	4	4	4	4	4	4
Avoid use of roads during wet periods.	4	4	3	4	4	4	4	4	4	4	4	4
Grade roads only as necessary to maintain drainage.	4	4	4	4	4	4	NA	NA	4	4	NA	NA
Avoid cutting the toe of cut slopes.	4	4	NA	NA	NA	NA	4	4	NA	NA	NA	NA
Exclusion of side-casting of road material into a stream.	4	4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Abandoned roads in condition to provide adequate drainage without further maintenance.	5	5	4	4	NA	NA	NA	NA	NA	NA	4	4

Land Ownership/ Timber Sale Identification	Federal Site #1		Federal Site #2		Private Site #1		Private Site #2		Private Site #3		State Site #1	
	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness
<b>Streamside Management Zone Designation</b>												
Adequate SMZ width identified.	5	4	4	4	4	4	4	4	4	4	4	4
SMZ properly marked?	4	4	4	4	4	4	3	4	3	4	4	4
Maintain or provide sufficient ground cover.	4	4	4	4	4	4	4	4	5	4	4	4
Equipment operation in SMZ allowed only per approved practices.	4	4	4	4	4	4	4	4	4	4	NA	NA
Exclusion of burning in SMZ.	4	4	4	4	NA	NA	3	4	3	4	4	4
SMZ retention tree requirements met. (Larger trees retained to provide habitat and a source of large woody material).	4	4	4	4	4	4	4	4	4	4	NA	NA
Exclusion of side-cast material into a stream, lake, wetland or other body of water during harvest/operation.	4	4	NA	NA	NA	NA	NA	NA	4	4	NA	NA
Exclusion of slash in streams, lakes or other bodies of water.	4	4	4	4	4	4	4	4	4	4	4	4
SMZ protected during site preparation activities.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Stream Crossings and Stream Bank Protection</b>	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness
Proper permits for stream crossings obtained.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cross streams at right angles, if practical.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Proper sizing for stream crossing structures.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Direct road drainage away from stream crossing site.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Avoid unimproved stream crossings. Use temporary log stream crossings if necessary.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Land Ownership/ Timber Sale Identification	Federal Site #1		Federal Site #2		Private Site #1		Private Site #2		Private Site #3		State Site #1	
	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness
<b>Installation of Stream Crossings</b> Minimize stream channel disturbance.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Erodible material not placed in stream channels.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Stream crossing culverts conform to natural streambed and slope.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Culverts placed slightly below stream grade.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Prevent erosion of stream crossing culverts and bridge fills (i.e. armor inlet and outlet).	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Minimum cover for stream crossing culverts provided.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Stream diversions are carefully planned to minimize downstream sedimentation.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>TIMBER HARVESTING, SLASH TREATMENT, THINNING AND REVEGETATION</b>	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness
<b>Harvest Design</b> Suitable logging system for soil type, topography and season of operation.	4	4	3	4	4	4	4	4	5	5	5	4
Design and locate skid trails to minimize soil disturbance. Use existing areas wherever possible.	4	4	4	4	4	4	4	4	4	5	4	4
Suitable location, size and number of landings. Use existing areas wherever possible.	4	4	4	4	4	4	4	4	4	4	4	4
<b>Other Harvesting Activities</b> Equipment/skidding operations minimize soil compaction and displacement.	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness
Avoid equipment/skidding operation on unstable, wet or easily compacted soils and on slopes that exceed 40% unless not causing excessive erosion.	4	4	4	4	4	4	4	4	4	4	4	4
	NA	NA	NA	NA	4	4	4	4	NA	NA	4	4

Land Ownership/ Timber Sale Identification	Federal Site #1		Federal Site #2		Private Site #1		Private Site #2		Private Site #3		State Site #1	
Appropriate drainage control for landing.	4	4	3	4	4	4	4	4	4	4	4	4
Appropriate drainage control for skid trails.	4	4	4	4	4	4	4	4	NA	NA	4	4
<b>Slash Treatment and Site Preparation</b>	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness
Scarify only to the extent necessary to meet resource management objective.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Treat slash so as to preserve the surface soil horizon.	4	4	4	4	4	4	4	4	4	4	4	4
Adequate material left to slow runoff, return soil nutrients and provide shade for seedlings.	4	4	4	4	4	4	4	4	4	4	4	4
Activities limited to frozen or dry conditions to minimize soil compaction and displacement.	4	4	4	4	4	4	4	4	4	4	4	4
Scarification on steep slopes in a manner that minimizes erosion.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Revegetation of Disturbed Areas</b>	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness
Practices have been completed to ensure adequate revegetation in disturbed areas.	4	4	4	4	4	4	4	4	5	4	4	4
<b>HAZARDOUS SUBSTANCES</b>	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness
Know and comply with regulations governing the storage, handling, etc. of hazardous substances.	4	4	4	4	4	4	4	4	4	4	4	4
Proper sites were selected for servicing and refueling to prevent contamination of waters from accidental spills.	4	4	4	4	4	4	4	4	4	4	4	4
Pesticide materials properly applied and effects monitored.	NA	NA	NA	NA	NA	5	4	4	4	4	NA	NA
Fertilizers properly handled and applied so as to reduce possible adverse effects on water quality.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Land Ownership/ Timber Sale Identification	Federal Site #1		Federal Site #2		Private Site #1		Private Site #2		Private Site #3		State Site #1	
	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness
<b>FIRE MANAGEMENT</b>												
<b>Protection of Soil and Water from Prescribed Burning Effects</b> Soil productivity is maintained, erosion is minimized. Ash, sediment, nutrients and debris are prevented from entering surface water. SMZ is maintained with no piling and/or burning permitted within SMZ.	4	4	4	4	NA	NA	4	4	4	4	4	4
<b>Stabilization of Fire Suppression Related Work Damage</b> Areas impacted by fire suppression activities have been stabilized.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Emergency Rehabilitation of Watersheds Impacted by Wildfires</b> Corrective measures have been applied to minimize the loss of soil productivity, deterioration of water quality, and threats to life and property, both on-site and off-site.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>COMMENTS:</b> <i>Federal Site #1:</i> Activity fuels piles not burned yet due to low snow level last year. <i>Federal Site #2:</i> Limited operating season due to recreational use and large number of vernal ponds. <i>Private Site #1:</i> Wildfire mitigation and forest health were primary objectives of treatment. <i>Private Site #2:</i> Parts of site operations adjacent to municipal water supply. <i>Private Site #3:</i> Winter season helicopter harvesting resulted in highest rank ever given for a BMP. <i>State Site #1:</i> Secondary & tertiary site treatment objectives include wildlife habitat and power line protection.												

# Appendix B

## Site Information and Ranking Criteria Field Form

CO - BMP1  
2018

### BMP FIELD MONITORING SITE INFORMATION and RANKING CRITERIA

Site Number: \_\_\_\_\_ Meets Selection Criteria: Y/N \_\_\_\_\_

Site Name: \_\_\_\_\_

Owner(s): \_\_\_\_\_

Legal Description: RNG. \_\_\_\_\_ TWP. \_\_\_\_\_ SEC. \_\_\_\_\_ County: \_\_\_\_\_

Primary Drainage: \_\_\_\_\_ Month/Year Harvested: \_\_\_\_\_

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

Unit Size (Ac): \_\_\_\_\_ Volume Removed (MBF): \_\_\_\_\_

Road Construction: YES \_\_\_\_\_ (If yes, when) \_\_\_\_\_ NO \_\_\_\_\_ Length: \_\_\_\_\_

Road Reconstruction: YES \_\_\_\_\_ (If yes, when) \_\_\_\_\_ NO \_\_\_\_\_ Length: \_\_\_\_\_

Slash Disposal Complete: \_\_\_\_\_ Method: \_\_\_\_\_

Logging Method: \_\_\_\_\_

Slope: 0-5% \_\_\_\_\_; 5-20% \_\_\_\_\_; 20-40% \_\_\_\_\_; 40%+ \_\_\_\_\_

Harvest in SMZ: Y / N

Comments:

#### 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 and 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

#### FIELD MONITORING

Date: \_\_\_\_\_

Team Leader/Recorder: \_\_\_\_\_

Team Members:

Observers Present:

NR – Not Reviewed      NA – Not Applicable

## Colorado Forest Practices Review Worksheet

Recommended Best Management Practices	Applicable to Site (Y/N)			Comments
	Application	Effectiveness		
<b>TIMBER SALE PLANNING</b> (*Guidelines page reference)				
<b>SANITARY GUIDELINES FOR THE CONSTRUCTION OF CAMPS</b>				
	1. Adequate sewer and soil waste considerations on site to protect water quality if camps are present. (*page 20)			
<b>ROADS</b>				
BMPs Applicable to:				
+ New Road Construction      # Existing Roads      ~ Reconstruction				
<b>ROAD DESIGN AND LOCATION</b>				
+ ~	1. Design roads to minimum standard necessary to accommodate anticipated use and equipment. (*page 5)			
+ ~	2. Minimize number and length of roads necessary. (*page 4)			
#	3. Use existing roads unless aggravated erosion will be likely. (*page 4)			
+	4. Avoid long and/or steep road grades. (*page 7)			
+	5. Locations avoid high-hazard sites (i.e., wet areas and unstable slopes). (*page 5)			
+	6. Minimize number of stream crossings. (*page 6)			
+	7. Stable stream crossing sites. (*page 5)			
+	8. Locate roads to provide access to suitable log landing areas. (*page 5)			
+	9. Locate roads a safe distance from streams. (*page 5)			
+	10. Keep roads outside of Stream Management Zones. (*page 5)			
<b>ROAD CONSTRUCTION / RECONSTRUCTION</b>				
~ #	1. Construct/reconstruct only to the extent necessary to provide adequate drainage and safety. (*page 6)			
~#+	2. Minimize earth moving activities when soils appear excessively wet. (*page 6)			
+ ~	3. Keep slope stabilization, erosion, sediment control work as current as possible, including "slash filter windrows." (*page 6)			
+ ~	4. Cut and fill slopes at stable angles. Slope ratio: _____. (*page 7)			
+ ~	5. Stabilize exposed soils (i.e., seeding, benching, mulching). (*page 7)			
+ ~	6. Avoid incorporating woody debris in road fill. (*page 7)			
+ ~	7. Leave existing rooted trees and shrubs at the toe of fill slope. (*page 7)			
+ ~	8. Balance cuts and fills or use full bench construction. (*page 8)			



Applicable to Site (Y/N)

Application  
Effectiveness**Comments**

+ ~	9. Road base or other material from borrow pits and gravel pits minimized. (*page 8)			
+ ~	10. Excess materials placed in location that avoids entering stream. (*page 8)			
+ ~	11. Avoid excavation into groundwater. (*page 8)			
+ ~	12. Exclusion of side-casting of road material into a stream, lake, wetland or other body of water. (*page 8)			
	<b>ROAD DRAINAGE</b>			
+	1. Vary road grade to reduce concentrated drainage. (*page 8)			
+~#	2. Provide adequate road surface drainage for all roads. (*page 8)			
+ ~	3. Space road drainage outlets so runoff will not exceed capacity of drainage outlets. (*pages 5, 10)			
+ ~	4. For in-sloped roads, plan ditch gradients of generally greater than 2%, but no more than 8%. (*page 9)			
+ ~	5. Construct drain dips deep enough into the subgrade so traffic will not obliterate them. (*page 9)			
+ ~	6. Install culverts at original gradient, otherwise rock armor or anchor downspouts. (*page 10)			
+~#	7. Design all relief culverts with adequate length and appropriate skew. Protect inflow end from erosion. (*pages 4, 10)			
+~#	8. Provide energy dissipators at drainage structure outlets where needed. (*page 10)			
+~#	9. Route road drainage through adequate filtration zones before entering a stream. (*page 10)			
	<b>ROAD MAINTENANCE</b>			
+~#	1. Maintain erosion control features if present (dips, ditches and culverts functional). (*page 11)			
+~#	2. Avoid use of roads during wet periods. (*page 11)			
+~#	3. Grade roads only as necessary to maintain drainage. (*page 11)			
#	4. Avoid cutting the toe of cut slopes. (*page 11)			
+ ~	5. Exclusion of side-casting of road material into a stream. (*page 8)			
+~#	6. Abandoned roads in condition to provide adequate drainage without further maintenance. (*page 11)			
	<b>STREAMSIDE MANAGEMENT ZONE DESIGNATION</b>			
	1. Adequate SMZ width identified, avg. width _____ (*page 12)			
	2. SMZ properly marked. (*page 13)			
	3. Maintain or provide sufficient ground cover. (*page 14)			
	4. Equipment operation in SMZ allowed only per approved practices. (*page 14)			
	5. Exclusion of pile burning in SMZ (*page 15).			

Applicable to Site (Y/N)

Application  
Effectiveness

**Comments**

	6. SMZ retention tree requirements met. (Larger trees retained to provide habitat and a source of large woody debris). (*page 15)			
	7. Exclusion of side-casting of road material into a stream, lake, wetland or other body of water during road maintenance. (*page 8)			
	8. Exclusion of slash in streams, lakes or other bodies of water. (*page 15)			
	9. SMZ protected during site preparation activities (*page 14)			
	<b><u>STREAM CROSSINGS AND STREAM BANK PROTECTION</u></b>			
+ ~	1. Proper permits (i.e. 404) for stream crossings obtained (if needed). (*page 25)			
+ ~	2. Cross streams at right angles, when practical. (*page 25)			
+ ~	3. Proper sizing for stream crossing structures. (*page 25)			
+ ~	4. Direct road drainage away from stream crossing site. (*page 25)			
+ ~	5. Avoid unimproved stream crossings. (*page 26)			
	<b><u>INSTALLATION OF STREAM CROSSINGS</u></b>			
+ ~	1. Minimize stream channel disturbance. (*page 26)			
+ ~	2. No material placed in stream channels. (*page 26)			
+ ~	3. Stream crossing culverts conform to natural streambed and slope. (*page 26)			
+ ~	4. Culverts placed slightly below stream grade. (*page 26)			
+ ~	5. Prevent erosion of stream crossing culverts and bridge fills (i.e., armor inlet and outlet). (*page 26)			
+ ~	6. Minimum cover for stream crossing culverts provided. (*page 11)			
+ ~	7. Stream diversions are carefully planned to minimize downstream sedimentation. (*pages 2, 10, 26)			
<b>TIMBER HARVESTING, THINNING, SLASH TREATMENT AND REVEGETATION</b>				
	<b><u>HARVEST DESIGN</u></b>			
	1. Suitable logging system for topography, soil type and season of operation. (*page 16)			
	2. Design and locate skid trails/primary transport network to minimize soil disturbance. (*page 19)			
	3. Suitable location, size and number of landings. (*page 19)			
	<b><u>OTHER HARVESTING ACTIVITIES</u></b>			
	1. Skidding operations minimize soil compaction and displacement. (*page 19)			
	2. Avoid tractor skidding on unstable, wet or easily compacted soils and on slopes that exceed 40% unless not causing excessive erosion. (*page 19)			
	3. Adequate drainage for landing. (*page 20)			

Applicable to Site (Y/N)

Application  
Effectiveness

**Comments**

	4. Adequate drainage for skid trails. (*page 20)				
<b><u>SLASH TREATMENT AND SITE PREPARATION</u></b>					
	1. Scarify only to the extent necessary to meet resource management objective. (*page 21)				
	2. Treat slash so as to preserve the surface soil horizon. (*page 21)				
	3. Adequate material left to slow runoff, return soil nutrients and provide shade for seedlings. (*page 21)				
	4. Activities limited to frozen or dry conditions to minimize soil compaction and displacement. (*page 21)				
	5. Scarification on steep slopes in a manner that minimizes erosion. (*page 21)				
<b><u>REVEGETATION OF DISTURBED AREAS</u></b>					
	1. Practices have been completed to ensure adequate revegetation in disturbed areas, if required. (*pages 18, 19, 21, 22)				
<b>HAZARDOUS SUBSTANCES</b> Including chemicals, fertilizers, fuels and pesticides					
	1. Know and comply with regulations governing the storage, handling, etc., of hazardous substances. (*page 23)				
	2. Proper sites were selected for servicing and refueling to prevent contamination of waters from accidental spills. (*page 24)				
	3. Pesticide materials have been properly applied and effects monitored. (*page 24)				
	4. Fertilizers have been properly handled and applied so as to reduce possible adverse effects on water quality. (*page 24)				
<b>FIRE MANAGEMENT</b>					
<b><u>PROTECTION OF SOIL AND WATER FROM PRESCRIBED BURNING EFFECTS</u></b>					
	1. Soil erosion is minimized. Ash, sediment, nutrients and debris are prevented from entering surface water, and SMZ is maintained. (*page 27)				
<b><u>STABILIZATION OF FIRE SUPPRESSION RELATED WORK DAMAGE</u></b>					
	1. Areas disturbed by fire suppression activities have been restored. (*page 27)				
<b><u>EMERGENCY REHABILITATION OF WATERSHEDS IMPACTED BY WILDFIRES</u></b>					
	1. Corrective measures have been applied to minimize soil loss, deterioration of water quality, and threats to life and property, both on-site and off-site. (*page 27)				
<b>ADDITIONAL COMMENTS:</b> (include significant weather events since the harvest if known)					

# HEALTHY FORESTS START HERE



## OUR MISSION

To achieve stewardship of Colorado's diverse forest environments for the benefit of present and future generations



.....  
Colorado State University  
5060 Campus Delivery  
Fort Collins, CO 80523-5060  
(970) 491-6303  
csfs.colostate.edu



WARNER COLLEGE  
OF NATURAL RESOURCES  
COLORADO STATE UNIVERSITY  
.....  
Colorado State University  
1401 Campus Delivery  
Fort Collins, CO 80523-1401  
(970) 491-4994  
warnercnr.colostate.edu

*In accordance with Federal law and U.S. Department of Agriculture policy, this institution is prohibited from discriminating on the basis of race, color, national origin, sex, age, or disability. (Not all prohibited bases apply to all programs.)*

*To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, Room 326-W, Whitten Building, 1400 Independence Avenue, SW, Washington, DC 20250-9410 or call (202) 720-5964 (voice and TDD). USDA is an equal opportunity provider and employer.*  
082020300