Colorado Forestry Best Management Practices

Forest Stewardship Guidelines for Water Quality Protection

2016 Field Monitoring Report

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Table of Contents

Cover photo: *Following best management practices for forestry activities, such as transporting logs as this contractor does on a skidder, helps safeguard Colorado's watershed resources.* Photo: *Meg Halford, 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 September 2016, an interdisciplinary team visited six timber harvest and/or fuel treatment sites along the southern Front Range of 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 2016 monitoring showed the application of BMPs was met or exceeded 84 percent of the time. Minor departures from the BMP applications occurred 10 percent of the time and major departures 6 percent of the time. BMPs were found to be effective in providing adequate or improved resource condition 90 percent of the time. In addition, minor and temporary effects were observed 4 percent of the time and minor/prolonged or major/temporary effects were observed 6 percent of the time.

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 94 percent of the time, with minor departures making up the remaining 6 percent. Private-land management activities met or exceeded BMP standards 70 percent of the time, and the majority of the departures (16 percent) were minor. Major departures from BMP application occurred 14 percent of the time on private-land projects.

BMP effectiveness on state forestlands was adequate 100 percent of the time, while effectiveness on federal forest sites was adequate 97 percent of the time. Minor and temporary effects accounted for the other 3 percent on federal sites. Private forest sites scored 79 percent in adequately protecting or improving conditions. Minor and temporary effects were observed 7 percent of the time and minor/prolonged or major/temporary effects observed 14 percent of the time on private lands.

Based on findings of this assessment, the monitoring team made several recommendations to address specific questions or concerns related to SMZs, road drainage and maintenance, equipment operations and ongoing monitoring.

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 2016 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 three field monitoring trips returned to a biennial schedule from 2012 through 2016.

The following individuals served on the 2016 field monitoring team:

- Tony Auciello, Jefferson County Open Space
- Joan Carlson, U.S. Forest Service
- Casey Cooley, Colorado Parks and Wildlife
- Rich Edwards, Colorado State Forest Service
- Peter Ismert, U.S. Environmental Protection Agency
- Peter Monahan, U.S. Environmental Protection Agency
- Molly Pitts, Colorado Timber Industry Association
- Laura Schweitzer, Wyoming State Forestry

The CSFS is grateful to these individuals, agencies and organizations for contributing to the 2016 BMP Field Monitoring. Although confidentiality of forestry/logging contractors and landowners is strictly maintained, the CSFS also values their assistance and cooperation.

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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 (http://www.epa.gov/nps). 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 that 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" 2012 and 2014 field audit reports are available at: *http://static.colostate.edu/client-files/csfs/pdfs/BestMgmtPractices2012FieldAuditReport_www.pdf*

https://csfs.colostate.edu/media/sites/22/2017/12/BMP_Audit_Oct2017-www.pdf

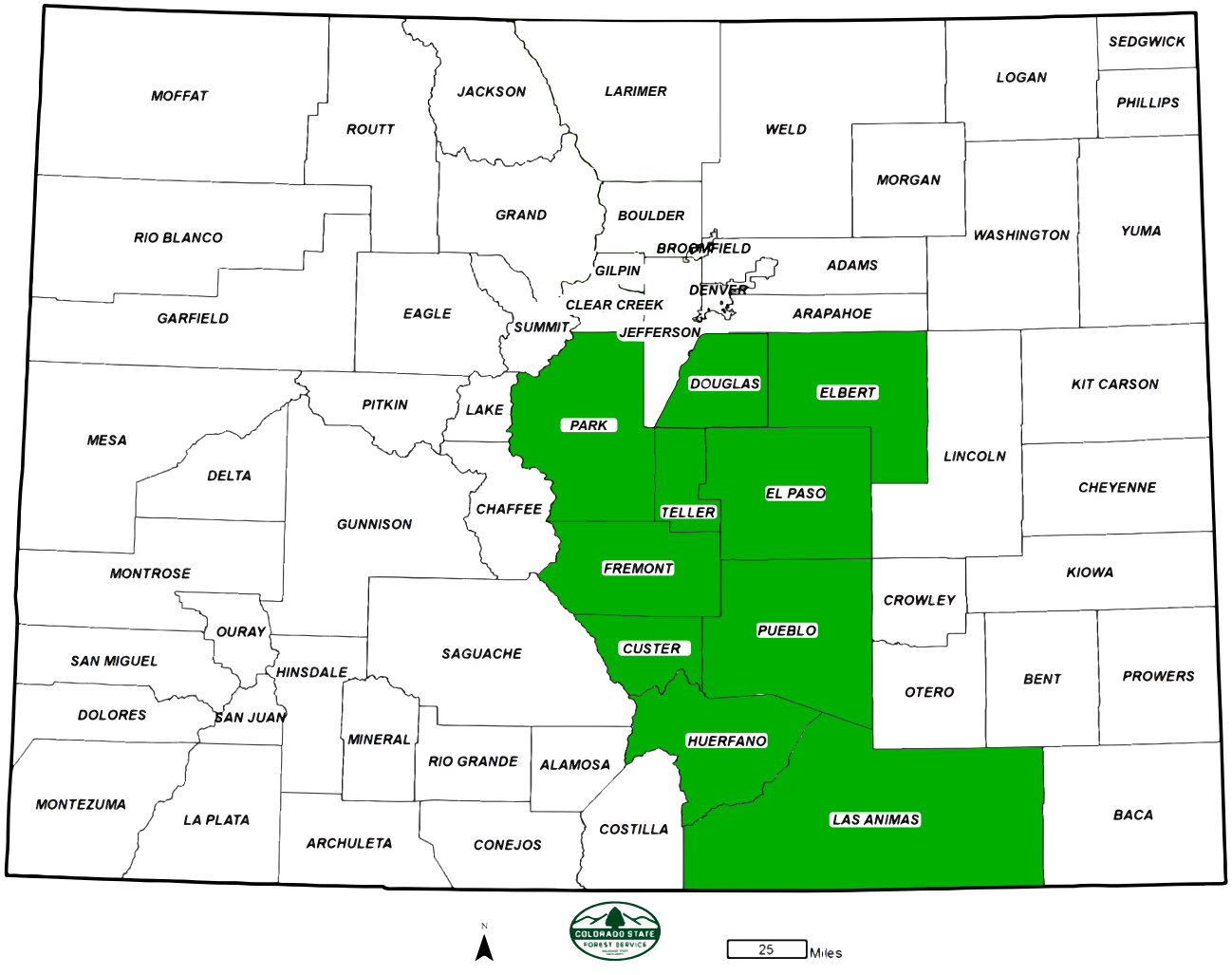
The Colorado Forestry BMP Monitoring process is designed to survey BMP compliance across the state. The 2010 CSFS "Colorado Statewide Forest Resource Assessment" identified 24.4 million acres

of forest and woodlands, with nearly 68 percent in federal ownership. The report cites: “Approximately 186,000 private landowners own 30 percent, or 7.1 million acres, of the state’s forested landscapes.” 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 2016 Colorado forestry BMP monitoring was the fourth 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 properties) 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 1: Counties that participated in the 2016 Colorado Forestry BMPs Field Monitoring



Monitoring Objectives

The 2016 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 2016 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 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 Custer, Douglas, Elbert, El Paso, Fremont, Huerfano, Las Animas, Park, Pueblo or Teller counties.

The minimum requirement of 1 Mbf 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 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 (Cañon City, Franktown, La Veta and Woodland Park). Previous monitoring has been conducted in other areas of the state. The long-term intent is to cover all forested areas in Colorado.

Overview of Selected Sites

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

Site nominations were solicited from one USDA Forest Service supervisor office, four CSFS field offices

Figure 2: The sale administrator briefs the monitoring team and answers questions prior to a site visit. Photo: Peter Ismert, U.S. EPA

Figure 3: The monitoring team inspects skid trails and the Streamside Management Zone. Photo: R.M. Edwards, CSFS

Figure 4: The monitoring team works on reaching consensus on BMP application and effectiveness ratings. Photo: Peter Ismert, U.S. EPA

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. This was used as a "practice" site for the monitoring team's new members. Another nearby, recently harvested site on private land (site #1) 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, except for federal sales #1 and #2, which were harvested/treated by the same contractor.

Monitoring Procedure

Field monitoring was conducted over four days, and the monitoring team spent approximately 2-3 hours on each fuel treatment/ timber sale site. Five 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 eight years. This allowed for significant cross-training of newer team members and helped improve understanding of rating criteria and applicability of the guide.

Personnel directly associated with each timber sale (either compliance forester or sale administrator) briefed the monitoring team on details of the 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.

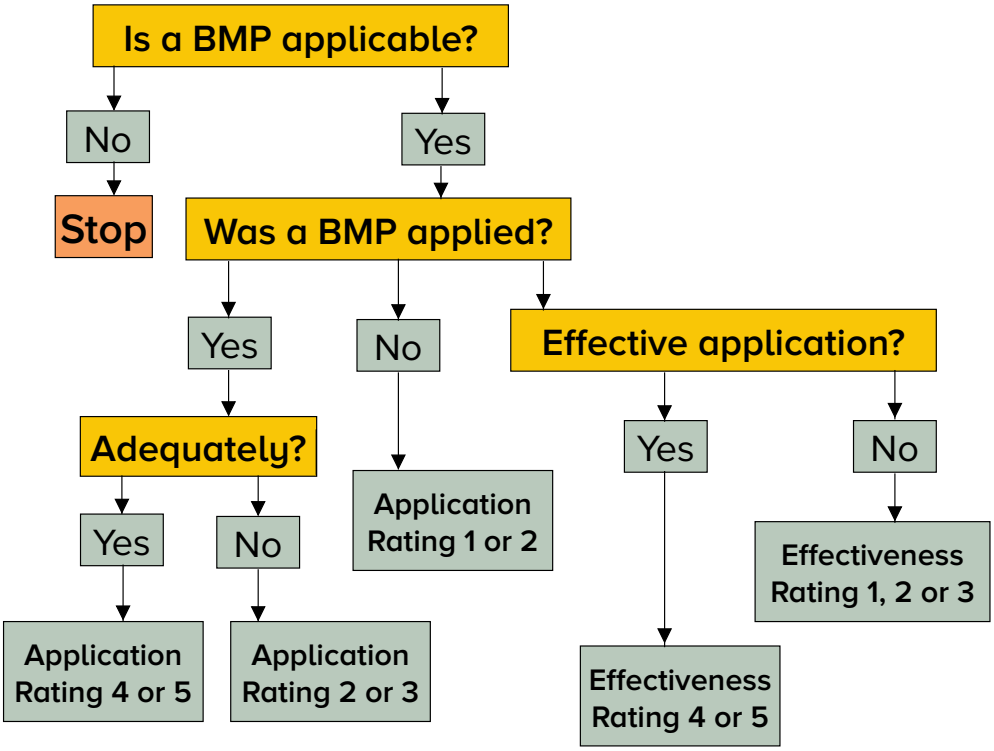


Figure 5: Colorado BMP Monitoring Ranking System

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 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.

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 2016 Field Monitoring Application Results, by Land Ownership

Ownership	Exceeded BMP	Met BMP Standard	Minor Departure	Major Departure	Gross Neglect	Total
Federal	2	63	4	0	0	69
	3%	91%	6%	0%	0%	100%
Private	4	52	13	11	0	80
	5%	65%	16%	14%	0%	100%
State	2	20	0	0	0	22
	9%	91%	0%	0%	0%	100%
Total	8	135	17	11	0	171
	5%	79%	10%	6%	0%	100%

Table 4: Colorado Forestry BMP 2016 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	66	1	0	0	69
	0%	97%	3%	0%	0%	100%
Private	1	62	6	11	0	80
	1%	78%	7%	14%	0%	100%
State	0	22	0	0	0	22
	0%	100%	0%	0%	0%	100%
Total	3	150	7	11	0	171
	2%	88%	4%	6%	0%	100%

Table 5: Comparison of BMP Application and Effectiveness Results, by Year Monitored (2008-2016)

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%
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%

Field Monitoring Results

In 2016, BMPs were met or exceeded 84 percent of the time (143 out of 171 rated items – Table 3). Minor departures occurred 10 percent of the time, mostly on private lands. Eleven major departures, 6 percent of the monitored projects, all occurred on private land. No gross neglect of any BMP was found on private, state or federal 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 first time any land classification has 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 90 percent over all ownerships (Table 4). At least adequate BMP effectiveness on federal and state forestlands occurred 97 percent and 100 percent of the time, respectively. Private lands were lower, with 79 percent experiencing adequate or improved conditions. Minor and temporary effects were observed 7 percent and 3 percent, respectively, for private and federal lands. Minor and prolonged or major and temporary effects were recorded on private lands 14 percent of the time. 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 land classification (i.e., state) has met or exceeded all BMP effectiveness ratings within its class. This is also the first time a given 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 2016. Table 5 illustrates the 2016 BMP application and effectiveness rating results for all landowners, compared to the results of the previous 2008, 2012 and 2014 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.

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 before reaching the highest level ever in 2016. 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 the highest level ever in 2016. Again, no major and prolonged effects were observed in 2016.

Based on the 2016 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 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, were minor in nature and occurred on one private site.

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, erodible soils were stabilized and excavation into ground water was avoided. On one of the federal sites where minimal standard water bars prior to use existed, the contractor upgraded these road structures to a higher standard and thus exceeded the BMP before the harvest unit was approved and closed out.

Road drainage

Road drainage was quite variable across the sites visited. The state site was rated adequate overall with no BMP departures, while protecting soil resources. Federal sites were rated adequate to fair in both application and effectiveness of BMPs. One federal site contained a minor road surface drainage issue in both application and effectiveness. Private sites, on the other hand, were rated adequate to poor. One private site contained all of the road drainage BMP departures found during this monitoring period. These included concerns related to road surfaces, lack of outlet energy dissipaters and inadequate filtration zones for road drainage.

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 avoiding the use of roads during wet periods and

leaving any abandoned roads in sufficient condition to provide adequate drainage. Minor departures with minor and temporary impacts were noted on one of the private sites with regard to minimizing road grading and avoiding cutting the toe of cut slopes. In addition, the same private site had a major departure and impacts in maintaining some of the in-road diversion structures.

Streamside Management Zone (SMZ) delineation

As in years past, the highest proportion of departures in BMP application and effectiveness occurred in the SMZ category. The state site scored the highest in this aspect with the application of two practices exceeding the BMP requirements. This consisted of a borderline ephemeral/intermittent stream course with a definable bed/bank, above the existing water table, being fully protected as an intermittent stream with an SMZ and with one designated skid-trail crossing. As a result, the entire SMZ was protected, and the monitoring team determined while on-site that the stream was indeed ephemeral.

One of the federal sites had two minor BMP application departures involving insufficient SMZ width and improper boundary marking around a reservoir area. The second federal site met or exceeded all BMPs in application and adequately protected soil and water resources. The SMZ width, in this case, was up to three times the minimum requirement of 50 feet.

The major departures of BMPs in this category occurred mostly on one private site, including inadequate SMZ width identified (i.e., 30 ft.), SMZ not properly marked, insufficient ground cover maintained, allowing equipment operation in the SMZ and not excluding slash in the stream. In addition, this site also contained a minor departure of not leaving an adequate number of retained trees (including larger trees to provide habitat and a source of large woody material). Effectiveness ratings of major and temporary impacts or minor and prolonged impacts to soil and water resources were given to all of the BMP application departures listed above except for not leaving an adequate number of retained trees, which was given a minor and temporary impact to soil and water resources.

The two other private sites rated relatively higher, with one site meeting all requirements of BMP application along with adequately protecting the site's soil and water resources for all effectiveness ratings. The only exception on this second site was exceeding the BMP SMZ width requirements, although a minor departure was noted in the improper marking of the SMZ. The third private site had a major departure in not properly marking the SMZ and a minor departure in adequate SMZ width. In addition, a minor departure was noted with some burn piles ignited within the SMZ. However, all effectiveness ratings adequately protected 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. One federal site exceeded this BMP by locating landings in future recreation-related planned disturbed areas. Both federal sites, two private sites and the state site used suitable logging systems for topography while designing and locating skid trails to minimize soil disturbance. One private site had minor departures in applying the BMP for utilizing a suitable logging system for topography, soil type and season of operation and in designing and locating skid trails. Only one of the BMP application departures regarding suitable logging systems for this site was given a minor and temporary impact to soil and water resources rating for its effectiveness. One of the private sites was rated as improving protection of soil and water resources over pre-project condition by implementing a very low impact, higher cost manual treatment approach.

Other harvesting activities

State sites scored the highest in this category by meeting all applied BMP requirements. The two federal sites only had one minor BMP departure in avoiding equipment skidding on unstable, wet or easily compacted soils and on slopes that exceed 40 percent unless not causing excessive erosion. However, associated BMP effectiveness was deemed to be adequate.

All harvest sites provided appropriate drainage control for landings. One private site had a minor departure in providing appropriate drainage control for skid trails and equipment operation minimizing soil compaction and displacement, although in both cases adequately protecting soil and water resources. On this same private site, a major departure was noted in avoiding equipment skidding on unstable, wet or easily compacted soils and on slopes that exceed 40 percent unless not causing excessive erosion. The associated practice effectiveness was rated as having major and temporary or minor and prolonged impacts on resources.

Of the other two private sites, one met all applied BMP requirements; the second met or exceeded all applied BMPs. On the second site, the contractor used a forwarder, resulting in significantly fewer impacts and exceeding the BMP application requirements. Effectiveness was recorded as adequate.

Slash treatment and site preparation

Scarification was not used on any of the sites. All sites left adequate slash material to slow runoff, return soil nutrients and provide shade for seedlings. One of the federal sites was deemed to have improved the protection of soil and water resources using mastication that enhanced surface material condition in the area. In addition, all sites limited activities to frozen or dry conditions to minimize soil compaction and displacement. On five of the six monitored sites, contractors treated slash in order to minimize disturbance of the surface soil horizon. Only one private site had a minor BMP departure. The effectiveness, in this case, was rated at a minor and temporary impact to soil and water resources.

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, except for one private site, met BMP application and effectiveness requirements. This site was rated with an application minor departure and effectiveness rating of major and temporary or minor and prolonged impacts on soil and water resources.

Pesticides, Fertilizers and Chemicals

Pesticides and fertilizers were not used on any of the sites that were visited. All sites had properly designated areas selected for servicing and refueling to prevent contamination of waters from accidental spills. On one private site, equipment fueling was all performed off-site and biodegradable bar oil was used in chainsaws. As a result, the monitoring team rated both applicable practices as exceeding the requirements of BMPs.

Fire Management

Protection of soil and water from the effects of prescribed burning

Only one of the private sites was rated with prescribed fire utilized. In addition, no wildfires occurred on any of the monitored sites. BMP application requirements were met on the private site; effectiveness was adequate.

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 2012 through 2016 occurred in the SMZ. In particular, one private site in 2016 included the second lowest application and effectiveness ratings recorded to date, including four practices recorded as “major departure from BMP” with “major/temporary or minor/prolonged impacts on soil and water resources.” As recommended in the past, it appears that additional, continued, focused outreach and training on this subject is required for forestry/logging operators, landowners and managers.
- More specific guidance is needed for forestry/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.

- One of the six sites (private) indicated that some level of ongoing monitoring was necessary in order to reassess re-vegetation efforts and progress, specifically in some burned slash piles.
- 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/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 2016 shows that application of BMPs in forestry and logging operations in Colorado occurred at a rate of 84 percent, with an effectiveness rate of 90 percent. The monitoring team is generally 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 team has made several recommendations and believes the application and effectiveness rates can be 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.

Notes

Notes

Appendix A

2016 Forestry BMP Field Monitoring Data and Rating Guide Criteria

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

Land Ownership/ Timber Sale Identification	Federal Sale #1		Federal Sale #2		Private Sale #1		Private Sale #2		Private Sale #3		State Sale #1	
Road Construction/ Reconstruction	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness
Construct/reconstruct only to the extent necessary to provide adequate drainage and safety.	4	5	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	4	4	NA	NA	NA	NA	NA	NA	NA	NA
Cut and fill slopes at stable angles.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Stabilize erodible soils (i.e., seeding, benching, mulching).	4	4	4	4	NA	NA	NA	NA	NA	NA	NA	NA
Avoid incorporating woody material in road fill.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Leave existing rooted trees and shrubs at the toe of fill slope.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Balance cuts and fills or use full bench construction.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment from borrow pits and gravel pits minimized.	4	4	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.	4	4	4	4	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.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Road Drainage	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness
Vary road grade to reduce concentrated drainage.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Provide adequate road surface drainage for all roads.	3	3	4	4	4	4	2	2	4	4	4	4
Space road drainage outlets so peak runoff will not exceed capacity of drainage outlets.	4	4	4	4	NA	NA	NA	NA	NA	NA	NA	NA

Land Ownership/ Timber Sale Identification	Federal Sale #1		Federal Sale #2		Private Sale #1		Private Sale #2		Private Sale #3		State Sale #1	
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.	4	4	4	4	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	4	4	NA	NA
Provide energy dissipaters at drainage structure outlets where needed.	4	4	4	4	NA	NA	2	2	4	4	NA	NA
Route road drainage through adequate filtration zones before entering a stream.	4	4	4	4	NA	NA	2	2	NA	NA	4	4
Road Maintenance	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	NA	NA	2	2	4	4	4	4
Avoid use of roads during wet periods.	4	4	4	4	4	4	4	4	4	4	4	4
Grade roads only as necessary to maintain drainage.	4	4	4	4	4	4	3	3	4	4	4	4
Avoid cutting the toe of cut slopes.	NA	NA	NA	NA	4	4	3	3	NA	NA	NA	NA
Exclusion of side-casting of road material into a stream.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Abandoned roads in condition to provide adequate drainage without further maintenance.	4	4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Land Ownership/ Timber Sale Identification	Federal Sale #1		Federal Sale #2		Private Sale #1		Private Sale #2		Private Sale #3		State Sale #1	
Streamside Management Zone Designation	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness
Adequate SMZ width identified.	3	4	5	4	5	4	2	2	3	4	4	4
SMZ properly marked?	3	4	4	4	3	4	2	2	2	4	5	4
Maintain or provide sufficient ground cover.	4	4	4	4	4	4	2	2	4	4	4	4
Equipment operation in SMZ allowed only per approved practices.	4	4	NA	NA	4	4	2	2	4	4	5	4
Exclusion of burning in SMZ.	NA	NA	NA	NA	NA	NA	NA	NA	3	4	NA	NA
SMZ retention tree requirements met. (Larger trees retained to provide habitat and a source of large woody material).	4	4	NA	NA	4	4	3	3	4	4	4	4
Exclusion of side-cast material into a stream, lake, wetland or other body of water during harvest/operation.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Exclusion of slash in streams, lakes or other bodies of water.	4	4	NA	NA	4	4	2	2	4	4	4	4
SMZ protected during site preparation activities.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Stream Crossings and Stream Bank Protection	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 Sale #1		Federal Sale #2		Private Sale #1		Private Sale #2		Private Sale #3		State Sale #1	
Installation of Stream Crossings	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness
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
TIMBER HARVESTING, SLASH TREATMENT, THINNING AND REVEGETATION	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness
Harvest Design												
Suitable logging system for soil type, topography and season of operation.	4	4	4	4	4	4	3	3	4	5	4	4
Design and locate skid trails to minimize soil disturbance. Use existing areas wherever possible.	4	4	4	4	4	4	3	4	NA	NA	NA	NA
Suitable location, size and number of landings. Use existing areas wherever possible.	5	4	4	4	4	4	4	4	4	4	NA	NA
Other Harvesting Activities	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness
Equipment/skidding operations minimize soil compaction and displacement.	4	4	4	4	5	4	3	4	4	4	4	4
Avoid equipment/skidding operation on unstable, wet or easily compacted soils and on slopes that exceed 40% unless not causing excessive erosion.	4	4	3	4	4	4	2	2	NA	NA	4	4

Land Ownership/ Timber Sale Identification	Federal Sale #1		Federal Sale #2		Private Sale #1		Private Sale #2		Private Sale #3		State Sale #1	
Appropriate drainage control for landing.	4	4	4	4	4	4	4	4	4	4	NA	NA
Appropriate drainage control for skid trails.	4	4	4	4	4	4	3	4	NA	NA	NA	NA
Slash Treatment and Site Preparation	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	3	3	4	4	4	4
Adequate material left to slow runoff, return soil nutrients and provide shade for seedlings.	4	5	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
Revegetation of Disturbed Areas	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	3	2	4	4	NA	NA
HAZARDOUS SUBSTANCES	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	5	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	5	4	4	4
Pesticide materials properly applied and effects monitored.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	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 Sale #1		Federal Sale #2		Private Sale #1		Private Sale #2		Private Sale #3		State Sale #1	
FIRE MANAGEMENT	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness
Protection of Soil and Water from Prescribed Burning Effects 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.	NA	NA	NA	NA	NA	NA	NA	NA	4	4	NA	NA
Stabilization of Fire Suppression Related Work Damage Areas impacted by fire suppression activities have been stabilized.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Emergency Rehabilitation of Watersheds Impacted by Wildfires 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

COMMENTS:
Federal Sale #1: Main objective of treatment was watershed/reservoir protection utilizing fuels and forest restoration treatments.
Federal Sale #2: Fuels reduction was primary treatment objective; forest restoration was secondary objective.
State Sale #1: Federal FEMA funds used for noncommercial (i.e., no wood utilization) wildfire mitigation along with adjacent treatments on Bureau of Land Management and Colorado Parks and Wildlife lands.
Private Sale #1: Work accomplished with federal USFS Community Assistance Funds (CAFA) fuels mitigation grant.
Private Sale #2: Fuels treatment / wildfire mitigation / watershed protection were main treatment objectives.
Private Sale #3: Site used as a "wildfire mitigation" demonstration area for surrounding community.

Appendix B
Site Information and Ranking Criteria Field Form

CO - BMP1
2016

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

NR – Not Reviewed NA – Not Applicable

FIELD MONITORING

Date: _____

Team Leader/Recorder: _____

Team Members:

Observers Present:

	Recommended Best Management Practices	Applicable to Site (Y/N)	Application	Effectiveness	Comments
	TIMBER SALE PLANNING (Guidelines page reference*)				
	SANITARY GUIDELINES FOR THE CONSTRUCTION OF CAMPS 1. Adequate sewer and soil waste considerations on site to protect water quality if camps are present. (*page 20)				
	ROADS BMPs Applicable to: + New Road Construction # Existing Roads ~ Reconstruction				
+~	**ROAD DESIGN AND LOCATION** 1. Design roads to minimum standard necessary to accommodate anticipated use and equipment. (*page 5)				
+~	2. Minimize number & 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)				
~#	**ROAD CONSTRUCTION / RECONSTRUCTION** 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)				

		Applicable to Site (Y/N)	Application	Effectiveness	Comments
+~	8. Balance cuts and fills or use full bench construction. (*page 8)				
+~	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)				
+	**ROAD DRAINAGE** 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. (*page 10)				
+~#	8. Provide energy dissipaters at drainage structure outlets where needed. (*page 10)				
+~#	9. Route road drainage through adequate filtration zones before entering a stream. (*page 10)				
+~#	**ROAD MAINTENANCE** 1. Maintain erosion control features (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)				
	STREAMSIDE MANAGEMENT ZONE DESIGNATION 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 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 material). (*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)				
+~	**STREAM CROSSINGS AND STREAM BANK PROTECTION** 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)				
+~	**INSTALLATION OF STREAM CROSSINGS** 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)				
TIMBER HARVESTING, THINNING, SLASH TREATMENT AND REVEGETATION					
	HARVEST DESIGN 1. Suitable logging system for topography, soil type and season of operation. (*page 16)				
	2. Design and locate skid trails to minimize soil disturbance. (*page 19)				
	3. Suitable location, size and number of landings. (*page 19)				
	OTHER HARVESTING ACTIVITIES 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)				

		Applicable to Site (Y/N)	Application	Effectiveness	Comments
	3. Adequate drainage for landing. (*page 20)				
	4. Adequate drainage for skid trails. (*page 20)				
	SLASH TREATMENT AND SITE PREPARATION 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)				
	REVEGETATION OF DISTURBED AREAS 1. Practices have been completed to ensure adequate revegetation in disturbed areas. (*pages 18, 19, 21)				
HAZARDOUS SUBSTANCES					
	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)				
FIRE MANAGEMENT					
	PROTECTION OF SOIL AND WATER FROM PRESCRIBED BURNING EFFECTS 1. Soil erosion is minimized. Ash, sediment, nutrients and debris are prevented from entering surface water, and SMZ is maintained. (*page 27)				
	STABILIZATION OF FIRE SUPPRESSION RELATED WORK DAMAGE 1. Areas disturbed by fire suppression activities have been restored. (*page 27)				
	EMERGENCY REHABILITATION OF WATERSHEDS IMPACTED BY WILDFIRES 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)				
ADDITIONAL COMMENTS: (include significant weather events since the harvest if known)					

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