

COLORADO FORESTRY
BEST MANAGEMENT PRACTICES
Forest Stewardship Guidelines for Water Quality
2008 Field Audit Report



December, 2008

Executive Summary

Water is a valuable commodity in Colorado that must be protected from non-point source pollution. In an effort to be proactive in protecting water quality, Colorado has implemented Best Management Practices (BMPs) for forestry activities. BMPs are a set of water quality protection measures and guidelines that provide direction on issues such as planning, harvesting, roads, chemical use, and fire management. Compliance with BMPs is voluntary, administered within a non-regulatory framework, and implementation monitoring serves as an acceptable surrogate for water quality monitoring.

An interdisciplinary team visited six timber harvest sites in north-central Colorado in September 2008 to assess Colorado forestry BMP application and effectiveness. Sites were selected from a combination of federal, state, and private lands based on specific site selection criteria. Each site was evaluated on planning, roads, harvesting, slash treatment, revegetation, chemical use, and fire management according to written criteria in the Field Audit Rating Guide.

The 2008 audit found that BMPs were met or exceeded 87% of the time. Major departures from the BMPs were 3% and no gross neglect of BMPs was found. Both state and federal timber sales had compliance rates of 91%. BMPs were effective in providing adequate resource or improved resource condition 81% of the time. Again, state, and federal effectiveness rates were 90 and 92%, higher than private land effectiveness.

Recommendations resulting from this audit included expanding information on prescribed burning in the Stream Side Management Zone, providing guidance for on site camp sanitation, adding new technologies for mitigated stream crossings, emphasizing the utilization of existing sites for landings, roads and trails, and planning for ongoing monitoring. The proposed monitoring effort will be to again monitor timber sales in 2010 for compliance and effectiveness and to compare data between the two audits to determine if BMP usage increases over time.

Table of Contents

Executive Summary	i
Table of Contents	iii
Acknowledgments	iv
Introduction	1
Audit Objectives	3
Audit Process	3
Audit Procedure	5
Field Audit Results	8
Recommendations	11
Summary	11
Appendix A – 2008 Field Audit Data and Rating Guide Criteria	A-1
Appendix B – Ranking Form	B-1

Acknowledgements

In order to ensure that Best Management Practices are being applied effectively during forestry and silviculture operations, the Colorado State Forest Service (CSFS) facilitated the formation of the 2008 Colorado Forestry BMP steering committee and audit team. The 2008 Colorado Forestry Audit signifies the initiation of a program that will be ongoing.

Credit is given to the individuals who so graciously gave their time and expertise to this interdisciplinary group. Photos for this report were provided by Greg Bohls.

State Audit BMP Steering Committee

Greg Bohls	United States Forest Service
Pat Davey	Natural Resources Conservation Service Colorado Office
Joseph Duda	Colorado State Forest Service
Randy Frank	Jefferson County Open Space
Scott Golden	Colorado Tree Farmers
Michael Hughes	Colorado State Forest Service
Marcella Hutchinson	US Environmental Protection Agency
Jeffery Kitchens	Bureau of Land Management
Ken Morgan	Colorado Division of Wildlife
Randal Ristau	Colorado Water Quality Control Division
John Stednick	Colorado State University, Watershed Science
Greg Sundstrom	Colorado State Forest Service (Committee lead)
Tom Troxel	Intermountain Forest Association/ Colorado Timber Industry Association

State Audit BMP Audit Team

Greg Bohls	United States Forest Service
Annikki Chamberlain	Colorado State University, Watershed Science
Michelle Cowardin	Colorado Division of Wildlife
Pat Davey	Natural Resources Conservation Service Colorado Office
Randy Frank	Jefferson County Open Space
Scott Golden	Colorado Tree Farmers
Michael Hughes	Colorado State Forest Service
Marcella Hutchinson	US Environmental Protection Agency
Ken Morgan	Colorado Division of Wildlife
Randal Ristau	Colorado Water Quality Control Division
John Stednick	Colorado State University, Watershed Science
Greg Sundstrom	Colorado State Forest Service (Team lead)
Tom Troxel	Intermountain Forest Association/ Colorado Timber Industry Association

Introduction

The forested lands of Colorado include the headwaters of several major rivers and produce large quantities of high quality water. In Colorado, over 50 percent of the population relies on these surface waters as their domestic water supply. These waters also provide for irrigation, livestock, recreation and industrial uses, and provide some of the western United States best fisheries. Given this importance, it is essential that measures be taken by landowners and managers to maintain surface water quality.

Forest timber is harvested from state, federal, and private lands in Colorado. The US Environmental Protection Agency (EPA) classifies forestry and silviculture activities as potential sources of nonpoint source pollution under the Clean Water Act (<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.”

The most significant NPS pollution from forestry and silviculture activities is excessive sediment entering waterways, usually from roads and skidding trails. Common practices in timber harvesting 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 improperly planned, located or constructed, these structures can intercept other surface waters and concentrate surface flow and transport sediment overland and into receiving waters. However, these sources of potential pollution are preventable if sound forestry and timber harvest practices are implemented.

Forestry Best Management Practices (BMPs) are a set of water quality protection measures and guidelines. BMPs provide direction on issues such as planning, harvesting, roads, chemical use and fire management. Implementation of BMPs can limit the nonpoint source pollution that forestry operations produce. Compliance with forestry BMPs is voluntary in Colorado, administered within a non-regulatory framework. BMP implementation monitoring serves an acceptable surrogate for water quality monitoring, a more quantitative, time consuming and expensive approach.

The Colorado Timber Industry Association (CTIA) and Colorado State Forest Service (CSFS) developed a booklet entitled Colorado Forest Stewardship Guidelines to Protect Water Quality, Best Management Practices (BMPs) for Colorado in 1998 with cooperative funding from CTIA, CSFS, the Colorado Nonpoint Source Task Force, and the U.S. Environmental Protection Agency. The booklets are available for the public at no cost through the CTIA and CSFS or on the Internet: http://csfs.colostate.edu/pdfs/bmp_screen.pdf

The Colorado Forestry BMP Audit process is designed to represent BMP compliance across the state. The Colorado NPS Management Plan states “Colorado has approximately 22.6 million acres of forestland, with 68 percent in federal ownership. An estimated 200,000 private landowners control 28 percent of the state’s forest;” Though “nearly 37 percent of the surface land of the state is federally owned, largely in headwaters areas”, much of the timber harvesting takes place on private lands. BMP audit sites were selected on timber sales from each major landowner group in the state: federal, state, and private.

Each site was evaluated on key components of the timber sale such as planning, roads, harvesting, slash treatment, re-vegetation, chemical use, and fire management using the field audit rating guide criteria (Appendix A). 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 2008 Colorado Forestry BMP Audit was the inaugural BMP audit for the state. The audit was conducted on a total of six timber harvest sites (two from each landowner group) by a team comprised of professionals in the fields of forestry, hydrology, wildlife, soil science, geology, and engineering from federal, state, and private sectors. Landowners and industry were represented on the team.

The BMP field audit project was funded through a grant from the Colorado Water Quality Control Division under the Clean Water Act, Section 319. This report details the findings of the 2008 Colorado Forestry BMP Audit.

2008 Audit Objectives

The role of the 2008 audit team was to evaluate the voluntary compliance to BMP standards detailed in the publication Colorado Forest Stewardship Guidelines to Protect Water Quality, Best Management Practices (BMPs) for Colorado. The overall goal was to proactively monitor the implementation of the state Forestry BMPs and evaluate the effectiveness of each. The 2008 audit report objectives include:

1. Monitor the effects of silviculture activities on water quality.
2. Monitor the avoidance and protection of wetland soil and water resources during harvest and road construction.
3. Monitor road-building effects (temporary/permanent roads/trails) in riparian areas under BMP strategy of minimizing the overall number of roads/trails and emphasizing the construction of erosion control measures.
4. Evaluate the level of timber harvest planning and design needed to maintain or improve the hydrographic character of timberlands; protect soils from erosion and streams from sedimentation during runoff periods.
5. Evaluate the protection of streamside management zones (SMZs) under the BMPs.
6. Include not only completed timber sales but also ongoing sales.

Audit Process

Site Selection

Sites were selected by the steering committee from a pool of timber sales on state, federal, and private forestland. In order to establish equal representation of each of these landowner groups and to focus on timber sales with the greatest potential to affect water quality, baseline criteria were used to select timber sales from a list of potential sites. Baseline criteria included:

1. Sale has potential to effect water quality.
2. Minimum of 1,000 board feet per acre harvested.
3. Sale completed within the last two years
4. Located in Routt, Jackson, Grand, Summit, or Eagle Counties.

The requirement of minimum 1,000 board feet harvested per acre was used to ensure against the selection of sales with only marginal potential to affect water quality. In addition, a great number of the timber sales in the state take place in areas where little or no live water or other sensitive hydrologic resources are present. While many BMPs are applicable to such timber sales, the audits focused on sales with potential to affect water quality. This selection against sales without major water quality concerns does create bias in the results as audits took place upon sales with a greater likelihood of including departures from the BMPs.

Overview of Selected Sites

The six timber sales selected for this first audit project were limited to a five county region of the state where there is significant salvage logging taking place due to a bark beetle epidemic (Figure 1). Two audited timber sales were located on USDA Forest Service land, two on Colorado state trust land, and two on private land.

Site nominations were solicited from 3 USFS Supervisor Offices, 2 CSFS District Offices and 5 CTIA members who had potential to be involved with or aware of harvest activities in the five county area.

Due to privacy issues, ownership and specific locations of the selected sites are not identified in this report. A different logging company (also not identified) harvested each site. Five of the six sites had been harvested during the winter, and one was being logged at the time of the audit.

The following map shows the audit county locations (Figure 1).



Figure 1. Colorado Forestry BMPs Field Audit Counties for 2008

Audit Procedure

The field audits were conducted over the course of four days, with the audit team spending approximately 2-3 hours on each timber sale. A practice audit was conducted on a non-selected site for training and proved invaluable for organizing the audit process and coordinating the audit team. The audit team modified some wording in the rating criteria during this session to improve the understanding and applicability of the guide.

Personnel directly associated with each timber sale (either compliance forester or sale administrator) briefed the audit team on the details of the harvest at each location. Areas of particular importance such as the stream management zone (SMZ), roads, and landing areas near the riparian corridor were identified, as were sale administration details. The audit 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 audit focused upon the critical portions of the timber sale where proper BMP application was most important.



The sale administrator briefing the audit team and answering questions prior to a site visit.



The audit team inspecting the closure of a temporary road

After inspecting these areas, the audit team reconvened to rate the timber sale’s compliance with the BMPs according to their observations and discussions. Consensus was reached on applicability, and then an application and effectiveness rating for each of the BMP items were recorded by a team leader on site. A different member of the team acted as team leader at each location. The BMP Field Audit Data and Rating Guide Criteria are attached (Appendix A).



The audit team working toward consensus on BMP application and effectiveness ratings

The rating process conducted for each BMP begins with establishing whether or not the BMP in question is applicable to the harvest activities under consideration. For example, not all harvest sites require the construction of temporary roads. In these cases; the BMPs pertaining to temporary roads are not applicable. Once the audit team establishes that a given BMP is applicable, the application rating for the BMP is determined based on written criteria (Table 1).

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 1. BMP Application Ratings and Criteria

The audit team then evaluated the BMP effectiveness. This determined whether the BMP was successful in the protection of water quality, again by written criteria (Table 2).

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.

Table 2. BMP Effectiveness Ratings and Criteria

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 lasting less than one season.
- Prolonged: Impacts lasting more than one year.

As audit sites were visited, notes were kept concerning how the Colorado Forest Stewardship Guidelines to Protect Water Quality, Best Management Practices (BMPs) for Colorado might be improved, and how future audits processes might be conducted. Those findings are included in the recommendations portion of this report.

Limits of the Audit Process

As previously explained, practicality, time, and resources prohibit evaluation of each timber sale from initiation to completion for compliance with BMPs. The audit process is designed instead to act as a “spot check”, limited to areas of the timber sale identified as having the greatest potential to affect water quality. There is also a limitation to the timing of the audit in the life of the timber sale, in that the audits can not simultaneously monitor the pre-sale, ongoing, and post-sale 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, a site where grass

seed mixtures have been applied but germination has not yet occurred generally assumed successful germination.

Field Audit Results

In 2008, BMPs were met or exceeded 87% of the time (206 out of 239 rated items) (Table 3). Minor departures occurred 11% of the time, with private landowners having the highest occurrence. All major departures, 6 counts or 3% of the total, occurred on private land. No gross neglect of any BMP was found. Federal timber sales and state timber sales scored the highest in application, having met or exceeded the BMP standard 91% of the time.

Ownership	Exceeded BMP	Met BMP Standard	Minor Departure	Major Departure	Gross Neglect	Total
Private	1	42	11	6	0	60
	2%	70%	18%	10%	0%	100%
State	2	79	8	0	0	89
	2%	89%	9%	0%	0%	100%
Federal	3	79	8	0	0	90
	3%	88%	9%	0%	0%	100%
Total	6	200	27	6	0	239
	3%	84%	11%	3%	0%	100%

Table 3. Colorado Forestry BMP 2008 Field Audit Application Results by Landownership

BMPs were effective at providing adequate protection or improved water resource conditions an average of 81% over all ownerships (Table 4). Federal and state forest lands had BMP effectiveness of 93% and 90% of the time respectively. Private lands were lower at 65% being adequate or improved conditions. Minor and temporary and minor and prolonged were 28% and 7% respectively for private lands. Major and prolonged effects were never observed.

Ownership	Minor/Prolonged					Total
	Improved Conditions	Adequate Protection	Minor and Temporary	or Major/Temporary	Major and Prolonged	
Private	0	40	17	4	0	61
	0%	65%	28%	7%	0%	100%
State	0	80	8	1	0	89
	0%	90%	9%	1%	0%	100%
Federal	1	83	6	0	0	90
	1%	92%	7%	0%	0%	100%
Total	1	160	30	5	0	196
	1%	81%	15%	3%	0%	100%

Table 4. Colorado Forestry BMP 2008 Field Audit Effectiveness Results by Landownership

In general, BMPs were properly applied and effective in nearly all cases. Using the 2008 Field Audit Data and Rating Guide Criteria (see Appendix A) some general comments on audit results can be made:

Planning

Sanitary guidelines for the construction of camps

When camps were present, sewage was contained on-site, additional BMPs were recommended, see Recommendations.

Roads

Road design and location

Most operators recognize the importance of road-stream intersections as a potential water quality concern and minimized the number of stream crossings to avoid high hazard sites; i.e. wet areas, unstable slopes, and groundwater. When roads were located near streams, proper distances from the streamside management zones were recognized, although some road drainage did enter the SMZ in 2 cases.

Road construction/reconstruction

Where road construction did occur, operators did not incorporate woody debris in the road fill except in one instance, minimized soil or rock borrow pit usage, and minimized earth movement activity. They used slash and surface roughness to minimize soil erosion and sediment transport. Unstable road cut and fill slopes (too steep) were found at one private site, where the road had received significant traffic, probably during wet periods, and was recognized as a temporary road.

Road drainage

In general, road drainage was adequate by varying road grade and providing road drainage outlets or drainage dips. Outlets were often armored with rock materials, or were diverted unto the undisturbed forest floor. Culverts were not used in any of the audit cases and no water quality issues were observed. In 2 cases, log cribbing (or log washboard) was used as a temporary stream crossing in winter harvest operations. In both state cases, channel degradation was a concern; one site used a geo-textile to keep eroding streambank material out of the stream, the other, pulled the logs, but site access by range cows resulted in streambank breakdown and channel widening. The geo-textile use is effective, but will require additional monitoring and perhaps maintenance, the range cows are a result of multiple land uses and is not the result of harvesting.

Road maintenance

One private operation built a new road with long uniform grades, had vertical cut slopes, probably from road traffic during wet periods, and had limited road drainage dips or outlets. The site manager thought this road would be decommissioned after the harvest. This single road segment did not use many of the BMPs suggested under Road Maintenance, otherwise road maintenance practices exceeded the BMP requirements and were protective of water resources.

Streamside Management Zone (SMZ) delineation

Before a SMZ can be marked, an adequate width should be identified. When the adequate width was identified, the BMP was noted to actually improve protection of soil and water. Equipment operation in the SMZ is allowed with approved practices and the guide needs to better reflect those opportunities (i.e., harvesting and burning).

There were departures in the streamside management zone (SMZ) designation on three of the six sites, one from each landowner group. There were major and minor departures in identifying an adequate SMZ width. Minor departures occurred due to failure to properly mark SMZ, maintain or provide sufficient ground cover, equipment operation in SMZ, and SMZ retention tree requirements, and one minor departure for failure to exclude slash from water bodies.

Stream crossings and streambank protection

All operators avoided the use of unimproved stream crossings. There were attempts to mitigate with a temporary log washboard (see above), but when the logs were pulled site disturbance resulted. Grass seed was applied, but success could not be evaluated.

Installation of stream crossings

No culverts were used and any stream crossing tended to conform to natural channel streambed slope.

Timber Harvesting, Thinning, Slash Treatment and Revegetation

Harvest design

All harvest sites used suitable logging systems with appropriate layouts of landings and skid trails. BMPs exceeded requirements and provided adequate soils and water protection.

Other harvesting activities

Same as above.

Slash treatment and site preparation

All sites had minimum soil disturbance or left sufficient slash cover to minimize overland flow and soil erosion. Scarification was never used to minimize soil erosion.

Revegetation of disturbed areas

Grass seeding was used in many areas, seeding rates were observed to be adequate, but germination and site establishment were not determined, thus some sites may need to be revisited to assess practice effectiveness.

Pesticides, herbicides, fertilizers, and chemicals

Pesticides and fertilizers were not used on any of these sites. Fueling practices tended to be from truck mounted tanks and away from surface waters.

Fire management

None of the BMPs were applicable for the audited sites since there was neither prescribed fire nor wildfires.

Recommendations

During the audit, several BMPs needed clarification, expansion, or new BMPs were suggested for addition. For future guidance documents and audits the following recommendations were made:

- Utilizing one of the nominated sites as a practice site to coordinate the team and lay out the audit process should be continued.
- Expanding information on prescribed burning in the Stream Side Management Zone.
- Providing more direct guidance for on site camp sanitation and hazardous material spill contingency plans for water quality protection.
- Emphasizing the utilization of previously used or existing sites for landings, roads and trails during harvest operations.
- Providing guidance for what is an acceptable practice during harvesting when soils are frozen versus when they are not is needed. The use of logs for stream crossings in winter is an example.
- Planning for ongoing monitoring of effectiveness, vegetation, and reforestation following harvest operations should be added as a BMP.
- Provide additional outreach and training to forest land managers and loggers on forestry related BMPs.
- Make the BMPs available to various user groups through online resources or other meetings.
- Adding harvest BMPs for wildlife habitat and water quantity resource concerns. These would include guidance for patch cut sizes, leave trees, and woody debris (logs) in stream channels. Guidance is needed about leaving woody debris in SMZs, especially as related to wildfire.
- Future audits should also include a visit to at least one previously audited site. In this audit, one of the sites on the State Forest was recommended for a second visit because some innovative technologies were used.

Summary

From the 2008 audit, it was determined that application of BMPs in timber harvesting in Colorado was 87% with an effectiveness of 91%. We are generally pleased with these levels. After this first audit, we have made several recommendations, and believe that 87% can be improved upon. The pine beetle epidemic will continue to increase timber harvesting rates in Colorado, particularly in areas that would typically not be considered for logging operations, but now present a fire, watershed, or forest health concern. It is important that BMPs are continually evaluated and adjusted as new issues and information are presented. The BMP audits will serve as the information source for updating state BMPs.

APPENDIX A

2008 Field Audit Data and Rating Guide Criteria

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

Choose stable stream crossing sites.	4	4	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	4	4	NA	4	NA	4	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	NA	NA
Keep roads outside of Stream Management Zones.	4	4	NA	NA	NA	NA	NA	NA	4	NA	4	NA	NA	NA
<u>B. Road Construction/ Reconstruction</u>	Application	Effectiveness	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	4	4	4	4	4	4	4	4	4	4	4	3	3
Minimize earth moving activities when soils appear excessively wet.	4	4	4	4	5	4	4	4	4	4	4	4	4	4
Keep slope stabilization erosion, sediment control work as current as possible, including "slash filter windrows".	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Cut and fill slopes at stable angles.	4	4	4	4	4	4	4	4	4	4	4	4	2	2
Stabilize erodible soils (i.e., seeding, benching, mulching).	NA	NA	NA	4	4	NA	4	4	4	4	4	4	NA	NA
Avoid incorporating woody debris in road fill.	NA	NA	NA	4	4	4	4	4	4	4	4	4	3	3
Leave existing rooted trees and shrubs at the toe of fill slope.	NA	NA	NA	4	4	4	4	4	4	4	4	4	NA	NA
Balance cuts and fills or use Full bench construction.	NA	NA	NA	4	4	4	4	4	4	4	4	4	3	3

Sediment from borrow pits and gravel pits minimized. Excess materials placed in location that avoid entering stream. Avoid excavation into ground water. Exclusion of side-casting of road material into a stream, lake, wetland or other body of water.	NA	NA	4	4	4	4	4	4	NA	NA	NA	NA	NA
	NA	NA	4	4	4	4	4	4	NA	NA	NA	NA	NA
	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	NA	NA	4	4	4	4	4	4	NA	NA	NA	NA	NA
C. Road Drainage	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Effectiveness
	4	4	4	4	4	NA	4	4	4	4	NA	NA	NA
Vary road grade to reduce concentrated drainage.	4	4	4	4	4	4	4	4	4	4	4	4	2
Provide adequate road surface drainage for all roads.	NA	NA	4	4	4	4	4	4	4	4	NA	NA	2
Space road drainage outlets so peak runoff will not exceed capacity of drainage outlets.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
For in sloped roads, plan ditch gradients of generally greater than 2%, but no more than 8%.	NA	NA	4	4	4	4	4	4	4	4	4	4	NA
Construct drain dips deep enough into the sub grade so that traffic will not obliterate them.	NA	NA	4	4	4	4	4	4	4	4	4	4	NA
Install culverts at original gradient, otherwise rock armor or anchor downspouts.	NA	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	NA

Provide energy dissipaters at drainage structure outlets where needed.	NA	NA	NA	NA	4	4	4	4	NA	NA	4	4	NA	NA	NA	NA	NA	
Route road drainage through adequate filtration zones before entering a stream.	NA	NA	4	4	4	4	4	4	4	4	4	4	4	NA	NA	NA	NA	
D. Road Maintenance	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness
Maintain erosion control features (drips, ditches and culverts functional).	NA	NA	4	4	4	4	4	4	4	4	4	4	4	NA	NA	NA	2	2
Avoid use of roads during wet periods.	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	2	3
Grade roads only as necessary to maintain drainage.	NA	NA	4	4	4	4	4	4	4	4	4	4	4	NA	NA	NA	3	3
Avoid cutting the toe of cut slopes.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Exclusion of side-casting of road material into a stream.	NA	NA	NA	NA	4	4	4	4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Abandoned roads in condition to provided adequate drainage without further maintenance.	4	4	4	4	4	4	4	4	NA	NA	4	4	4	NA	NA	NA	NA	NA
E. Streamside Management	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness
Zone Designation	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness
Adequate SMZ width identified.	3	3	4	4	5	4	4	4	5	4	4	4	4	4	4	4	2	3
SMZ properly marked?	4	4	4	4	4	4	4	4	3	3	4	4	4	4	4	3	3	3
Maintain or provide sufficient ground cover.	3	3	4	4	4	4	4	4	3	4	4	4	4	4	4	4	4	3
Equipment operation in SMZ allowed only per approved practices.	3	3	NA	NA	4	4	4	4	4	4	4	4	4	4	4	4	3	3
Exclusion of burning in SMZ.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4	4	4	4	4	4	4	4

SMZ retention tree requirements met. (Larger trees retained to provide habitat and a source of large woody debris).	4	4	4	4	4	4	3	4	4	4	4	4	4	4
Exclusion of side-casting of road material into a stream, lake, wetland or other body of water during road maintenance.	NA	NA	NA	4	4	4	NA	4	4	NA	NA	NA	NA	NA
Exclusion of slash in streams, lakes or other bodies of water.	4	4	NA	4	4	4	4	4	4	4	4	4	4	3
SMZ protected during site Preparation activities.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<u>F. Stream Crossings and Stream Bank Protection</u>	Application	Effectiveness	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	NA	NA
Cross streams at right angles, if practical.	4	4	4	4	4	4	4	4	4	4	4	4	4	NA
Proper sizing for stream crossing structures.	4	3	4	4	4	4	4	4	4	4	4	4	4	NA
Direct road drainage away from stream crossing site.	3	4	4	4	3	4	4	4	4	5	4	4	4	NA
Avoid unimproved stream crossings.	NA	NA	4	4	4	4	4	NA	NA	NA	NA	NA	NA	NA
<u>G. Installation of Stream Crossings</u>	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness
Minimize stream channel disturbance.	3	2	4	4	4	4	4	4	4	4	4	4	4	NA
Erodible material not place in stream channels.	4	4	4	4	4	4	4	4	4	4	4	4	4	NA
Stream crossing culverts conform to natural streambed and slope.	NA	NA	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	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	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Minimum cover for stream crossing culverts provided.	NA	NA	NA	NA	NA	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
Stream diversions are carefully planned to minimize downstream sedimentation.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
TIMBER HARVESTING, THINNING, SLASH TREATMENT AND REVEGETATION																										
A. Harvest Design	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness
Suitable logging system for topography, soil type and season of operation.	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
Design and locate skid trails to minimize soil disturbance.	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
Suitable location, size, and number of Landings.	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
B. Other Harvesting Activities	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness
Skidding operations minimizes soil compaction and displacement.	4	4	4	4	5	3	3	3	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
Avoid tractor skidding on unstable, wet or easily compacted soils and on slope that exceed 40% unless not causing excessive erosion.	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	

Adequate drainage for landing.	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Adequate drainage for skid trails.	3	3	4	4	4	4	4	4	4	4	4	4	4	3	3
C. <u>Slash Treatment and Site Preparation</u>	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Effectiveness
Scarify only to the extent necessary to meet resource management objective.	NA	NA	NA	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	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	4	4	3
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	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	NA	NA	NA
D. <u>Revegetation of Disturbed Areas</u>	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Effectiveness
Practices have been completed to ensure adequate revegetation in disturbed areas.	NA	NA	4	4	NA	NA	NA	4	4	4	4	4	NA	NA	NA
PESTICIDES, HERBICIDES, FERTILIZERS AND CHEMICALS	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	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	4	3	3

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	4	
	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Pesticide materials have been properly applied and effects monitored.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Fertilizers have been 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	NA	
	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
FIRE MANAGEMENT	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness	Application	Effectiveness
A. <u>Protection of Soil and Water from Prescribed Burning Effects</u>	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	NA	NA	NA	NA	4	NA	4	NA	4	NA	4	NA	NA	NA
Soil productivity is maintained, erosion is minimized. Ash, sediment, nutrients and debris is prevented from entering surface water. SMZ is maintained.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. <u>Stabilization of Fire Suppression Related Work Damage</u>	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Areas impacted by fire suppression activities have been stabilized.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

C. <u>Emergency Rehabilitation of Watersheds Impacted by Wildfires</u>	Application	NA	Effectiveness	NA	Application	NA	Effectiveness	NA	Application	NA	Effectiveness	NA	Application	NA	Effectiveness	NA	Application	NA	Effectiveness	NA	Application	NA	Effectiveness	NA	
<p>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.</p>																									

COMMENTS:

BMP FIELD AUDITS
SITE INFORMATION and RANKING CRITERIA

Site Number: _____

Meets Selection Criteria: Y/N _____
High Hazard: Y/N _____; Riparian _____ Matrix _____

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%+ _____

Parent Material: _____

Rating Guide

Soil Erodibility: High _____ Medium _____ Low _____

Harvest in SMZ: Y / N

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

Comments:

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

FIELD AUDIT

Date: _____

Team Leader/Recorder: _____

Team Members:

Observers Present:

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

COLORADO FOREST PRACTICES REVIEW WORKSHEET

RECOMMENDED BEST MANAGEMENT PRACTICES	APPLICABLE TO SITE (Y/N) APPLICATION EFFECTIVENESS			COMMENTS
	TIMBER SALE PLANNING (Guidelines page reference*)			
<u>SANITARY GUIDELINES FOR THE CONSTRUCTION OF CAMPS</u>				
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
<u>ROAD DESIGN AND LOCATION</u>				
➤+ 1.	Design roads to minimum standard necessary to accommodate anticipated use and equipment. (*page 5)			
➤+ 2.	Minimize number of roads necessary. (*page 6)			
# 3.	Use existing roads unless aggravated erosion will be likely. (*page 6)			
+ 4.	Avoid long, sustained, steep road grades. (*page 6)			
+ 5.	Locations avoid high-hazard sites (i.e., wet areas and unstable slopes). (*page 6)			
+ 6.	Minimize number of stream crossings. Number _____. (*page 6)			
+ 7.	Choose stable stream crossing sites. (*page 6)			
+ 8.	Locate roads to provide access to suitable log landing areas. (*page 6)			
+ 9.	Locate roads a safe distance from streams when they are parallel. (*page 6)			
+ 10.	Keep roads outside of Stream Management Zones. (*page 6)			
<u>ROAD CONSTRUCTION / RECONSTRUCTION</u>				
➤ # 1.	Construct/reconstruct only to the extent necessary to provide adequate drainage and safety. (*page 8)			
+➤#2.	Minimize earth moving activities when soils appear excessively wet. (*page 8)			

+➤ 3.	Keep slope stabilization, erosion, sediment control work as current as possible, including "slash filter windrows". (*page 8)				
+➤ 4.	Cut and fill slopes at stable angles. Slope ratio: _____. (*page 8)				
+➤ 5.	Stabilize erodible soils (i.e., seeding, benching, mulching). (*page 8)				
+➤ 6.	Avoid incorporating woody debris in road fill. (*page 8)				
+➤ 7.	Leave existing rooted trees and shrubs at the toe of fill slope. (*page 8)				
+➤ 8.	Balance cuts and fills or use full bench construction. (*page 9)				
+➤ 9.	Sediment from borrow pits and gravel pits minimized. (*page 9)				
+➤ 10.	Excess materials placed in location that avoid entering stream. (*page 9)				
+➤ 11.	Avoid excavation into ground water. (*page 9)				
+➤ 12.	Exclusion of side-casting of road material into a stream, lake, wetland or other body of water. (*page 9)				
<u>ROAD DRAINAGE</u>					
+ 1.	Vary road grade to reduce concentrated drainage. (*page 10)				
+➤# 2.	Provide adequate road surface drainage for all roads. (*page 10)				
+➤ 3.	Space road drainage outlets so peak runoff will not exceed capacity of drainage outlets. (*page 10)				
+➤ 4.	For in sloped roads, plan ditch gradients of generally greater than 2%, but no more than 8%.(*page 10)				
+➤ 5.	Construct drain dips deep enough into the sub grade so that traffic will not obliterate them. (*page 10)				
+➤ 6.	Install culverts at original gradient, otherwise rock armor or anchor downspouts. (*page 11)				
+➤# 7.	Design all relief culverts with adequate length and appropriate skew. Protect inflow end from erosion. Catch basins where appropriate. (*page 11)				
+➤# 8.	Provide energy dissipaters at drainage structure outlets where needed. (*page 11)				
+➤# 9.	Route road drainage through adequate filtration zones before entering a stream. (*page 11)				

<u>ROAD MAINTENANCE</u>							
+>#	1.	Maintain erosion control features (dips, ditches and culverts functional). (*page 12)					
+>#	2.	Avoid use of roads during wet periods. (*page 12)					
+>#	3.	Grade roads only as necessary to maintain drainage. (*page 12)					
#	4.	Avoid cutting the toe of cut slopes. (*page 12)					
+>	5.	Exclusion of side-casting of road material into a stream. (*page 12)					
+>#	6.	Abandoned roads in condition to provided adequate drainage without further maintenance. (*page 13)					
<u>STREAMSIDE MANAGEMENT ZONE DESIGNATION</u>							
	1.	Adequate SMZ width identified, avg. width _____. (*page 18)					
	2.	SMZ properly marked? (*page 18)					
	3.	Maintain or provide sufficient ground cover. (*page 19)					
	4.	Equipment operation in SMZ allowed only per approved practices. (*page 19)					
	5.	Exclusion of burning in SMZ (*page 9).					
	6.	SMZ retention tree requirements met. (Larger trees retained to provide habitat and a source of large woody debris). (*page 19)					
	7.	Exclusion of side-casting of road material into a stream, lake, wetland or other body of water during road maintenance. (*page 12)					
	8.	Exclusion of slash in streams, lakes or other bodies of water. (*page 19)					
	9.	SMZ protected during site preparation activities. (*page 25)					
<u>STREAM CROSSINGS AND STREAM BANK PROTECTION</u>							
>+	1.	Proper permits for stream crossings obtained. (*page 30)					
>+	2.	Cross streams at right angles, if practical. (*page 31)					
>+	3.	Proper sizing for stream crossing structures. (*page 31)					
>+	4.	Direct road drainage away from stream crossing site. (*page 31)					
>+	5.	Avoid unimproved stream crossings. (*page 31)					
<u>INSTALLATION OF STREAM CROSSINGS</u>							
>+	1.	Minimize stream channel disturbance. (*page 32)					
>+	2.	Erodible material not place in stream channels. (*page 32)					

➤+ 3.	Stream crossing culverts conform to natural streambed and slope. (*page 32)				
➤+ 4.	Culverts placed slightly below stream grade. (*page 32)				
➤+ 5.	Prevent erosion of stream crossing culverts and bridge fills (i.e., armor inlet and outlet). (*page 32)				
➤+ 6.	Minimum cover for stream crossing culverts provided. (*page 32)				
+➤ 7.	Stream diversions are carefully planned to minimize downstream sedimentation. (*page 32)				

TIMBER HARVESTING, THINNING, SLASH TREATMENT AND REVEGETATION

HARVEST DESIGN					
1.	Suitable logging system for topography, soil type and season of operation. (*page 21)				
2.	Design and locate skid trails to minimize soil disturbance. (*page 23)				
3.	Suitable location, size, and number of Landings. (*page 23)				
OTHER HARVESTING ACTIVITIES					
1.	Skidding operations minimizes soil compaction and displacement. (*page 24)				
2.	Avoid tractor skidding on unstable, wet or easily compacted soils and on slopes that exceed 40% unless not causing excessive erosion. (*page 24)				
3.	Adequate drainage for landing. (*page 24)				
4.	Adequate drainage for skid trails. (*page 24)				
SLASH TREATMENT AND SITE PREPARATION					
1.	Scarify only to the extent necessary to meet resource management objective. (*page 25)				
2.	Treat slash so as to preserve the surface soil horizon. (*page 25)				
3.	Adequate material left to slow runoff, return soil nutrients and provide shade for seedlings. (*page 25)				
4.	Activities limited to frozen or dry conditions to minimize soil compaction and displacement. (*page 25)				
5.	Scarification on steep slopes in a manner that minimizes erosion. (*page 25)				
REVEGETATION OF DISTURBED AREAS					
1.	Practices have been completed to ensure adequate revegetation in disturbed areas. (*page 8, 24)				

PESTICIDES, HERBICIDES, FERTILIZERS AND CHEMICALS

1. Know and comply with regulations governing the storage, handling, etc. of hazardous substances. (*page 29)				
2. Proper sites were selected for servicing and refueling to prevent contamination of waters from accidental spills. (*page 29)				
3. Pesticide materials have been properly applied and effects monitored. (*page 29)				
4. Fertilizers have been properly handled and applied so as to reduce possible adverse effects on water quality. (*page 29)				

FIRE MANAGEMENT

PROTECTION OF SOIL AND WATER FROM PRESCRIBED BURNING EFFECTS

1. Soil productivity is maintained, erosion is minimized. Ash, sediment, nutrients and debris is prevented from entering surface water. SMZ is maintained. (*page 26)

STABILIZATION OF FIRE SUPPRESSION RELATED WORK DAMAGE

1. Areas impacted by fire suppression activities have been stabilized. (*page 20)

EMERGENCY REHABILITATION OF WATERSHEDS IMPACTED BY WILDFIRES

1. 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. (*page 20)

ADDITIONAL COMMENTS: (include significant weather events since the harvest if known)