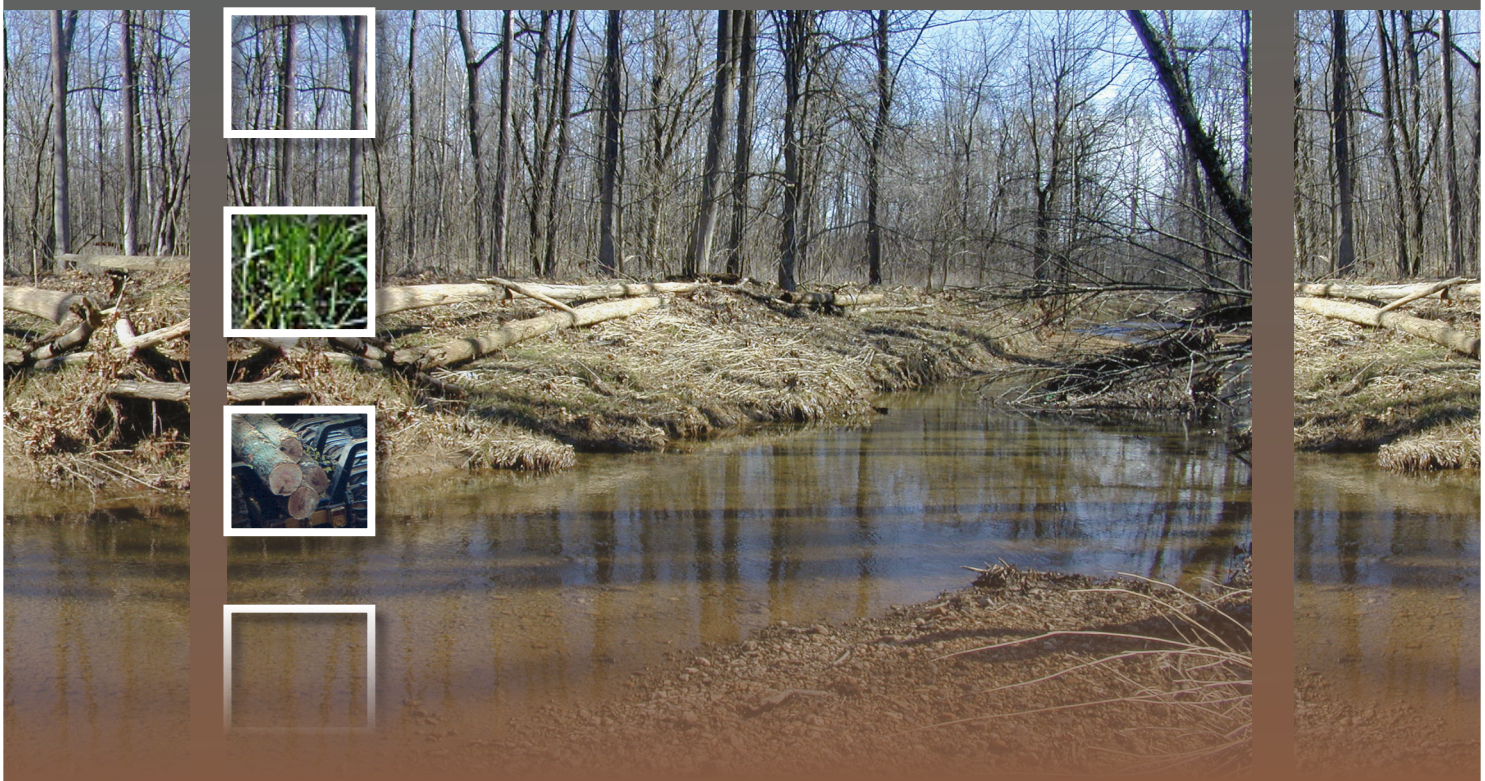
INDIANA DNR DIVISION OF FORESTRY

STATE FOREST PROPERTIES



Third Party Audit 2007
Forestry Best Management Practices
Monitoring Results

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Third-Party Audit State Forest BMP Report

I. Executive Summary

Forestry Best Management Practices (BMP) monitoring, as an internal audit by Division of Forestry (DoF) personnel of all timber harvests on State Forest properties, began Nov. 1, 2000. The timber harvests being monitored were sold starting July 1, 1999, when Forestry BMPs were included on the timber sale contract and enforced, even though they were commonly practiced before that date. The Statewide Forestry BMP program had conducted four rounds of monitoring before that time in which state properties had been monitored by teams including DoF personnel as well as private and industry people interested in forestry in Indiana.

It was determined in early 2006 that an external or third-party audit of BMP monitoring be conducted every year in perpetuity to ensure the accuracy of the DoF's internal audits. A total of 10 % of sites monitored each year are to be reviewed. Sites monitored in 2005 and 2006 are included in this audit, which took place in July 2007. Three sites monitored in each of the two years were randomly chosen for audit. In October 2008, three randomly chosen sites that were monitored by state personnel in 2007 also were audited. The comparisons being made throughout this report are for the nine sites that the external auditors monitored for BMPs, unless otherwise stated.

The overall BMP application rate for the nine sites monitored by state employees was 91.8% and the overall BMP application rate as determined by the third-party auditors at those same sites was 92.2% (Figure 1a). Of the nine sites included in this comparison study, the state monitors found there were minor departures in BMP application 8.25% of the time, or in 32 instances (Figure 2a). The third-party auditors found minor departures in application 7.28% of the time, or in 27 instances, and a 0.54% major departure of BMP application, meaning that major departures happened in two instances (Figure 2b).

The overall BMP effectiveness rate for sites monitored by state employees was 97.4% and the effectiveness scores from the third-party audit was 98.9% (Figure1b). State monitors found 10 departures in effectiveness. Three of the departures (0.77%) were determined to have an indirect and temporary impact; four departures (1.03%) had an indirect and prolonged effect (Figure 3a). One (0.26%) direct and temporary impact to soil and water quality was found, while two departures (0.52%) were determined by state BMP monitors to have a direct and prolonged impact (Figure 3a). Third-party monitors found only four departures in BMP effectiveness; two (0.54%) were determined to have an indirect and temporary effect on soil and water resources of the sites, one (0.27%) had an indirect and prolonged impact, and the other (0.27%) had a direct, temporary impact (Figure 3b).

The overall rates of the internal monitoring for forestry BMPs on State Forests since 1996 are 88.9% application and 94.6% effectiveness in protecting the soil and water quality of the 187 sites internally

monitored (Figures 1a & b). This means that 88.9% of the practices were applied as directed in the BMP guidelines, and another 10.8% were departures that were classified as minor, per the monitoring sheet (Appendix B). There have been 26 major departures, which account for 0.37% of all practices monitored.

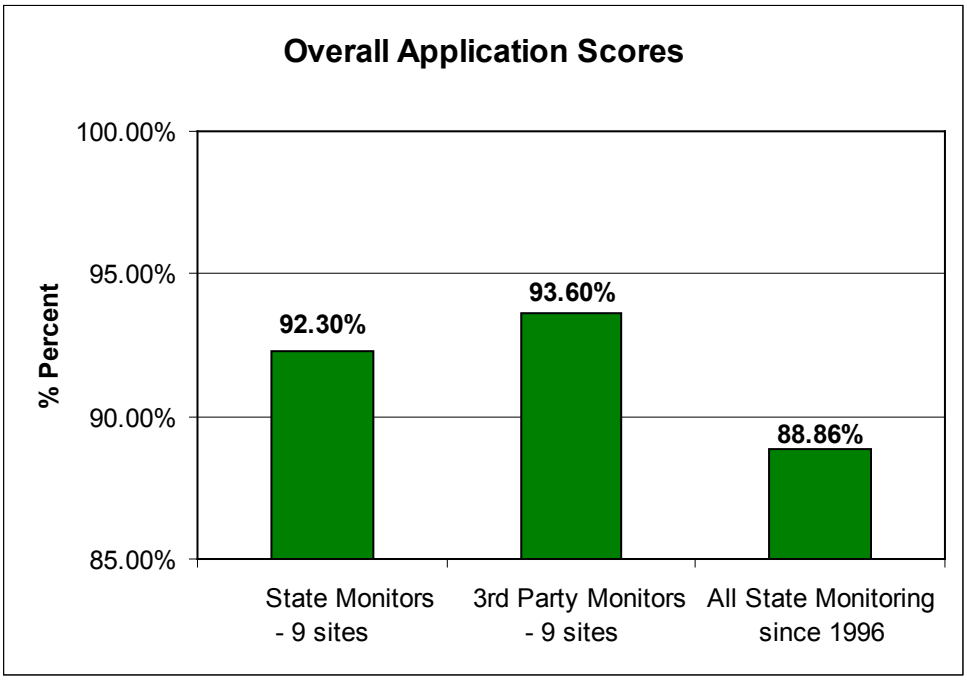

Figure 1a. Overall BMP application scores for the nine sites monitored by both state and third-party groups compared to the overall application score for the 187 State Forest harvest sites monitored for BMPs from 1996 to 2007.

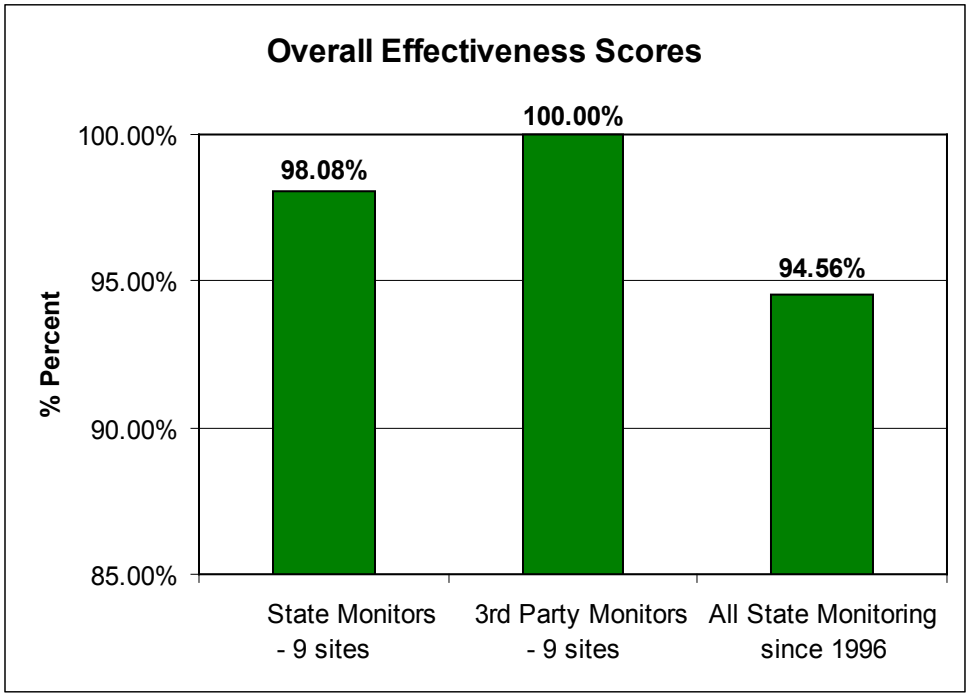

Figure 1b. Overall BMP effectiveness scores for the nine sites monitored by both state and third-party groups compared to the overall effectiveness score for the 187 state forest harvest sites monitored for BMPs from 1996 to 2007.

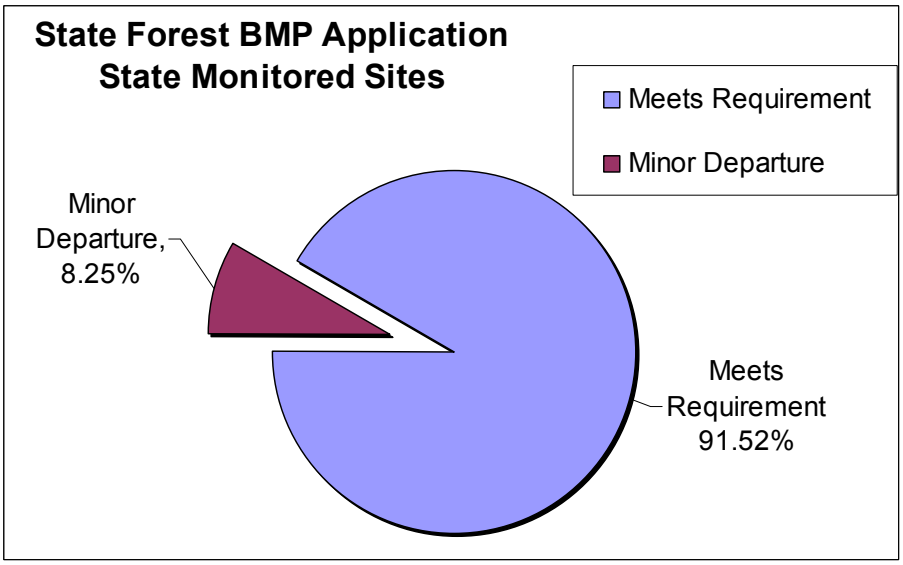

Figure 2a. State Forest BMP application %s for the nine sites monitored by state personnel.

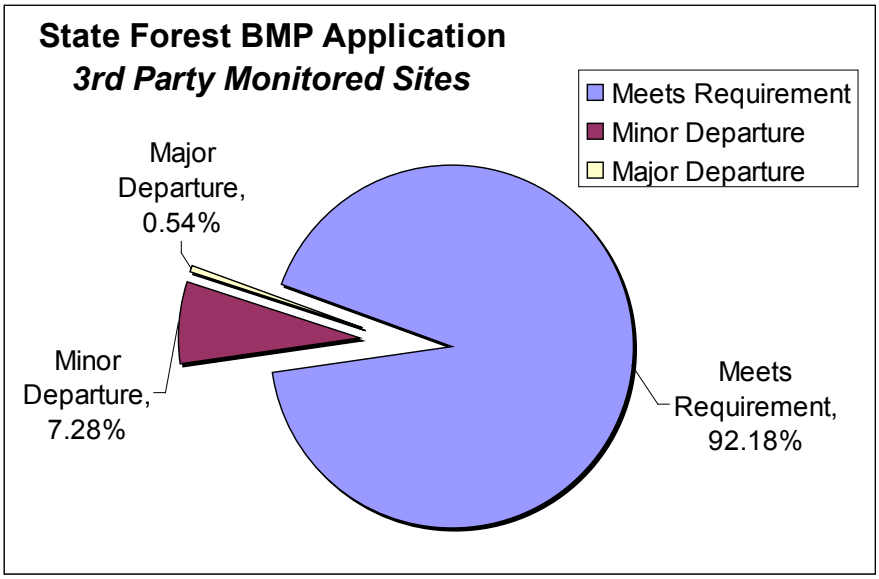

Figure 2b. State Forest BMP application %s for the nine sites monitored by the third-party audit team.

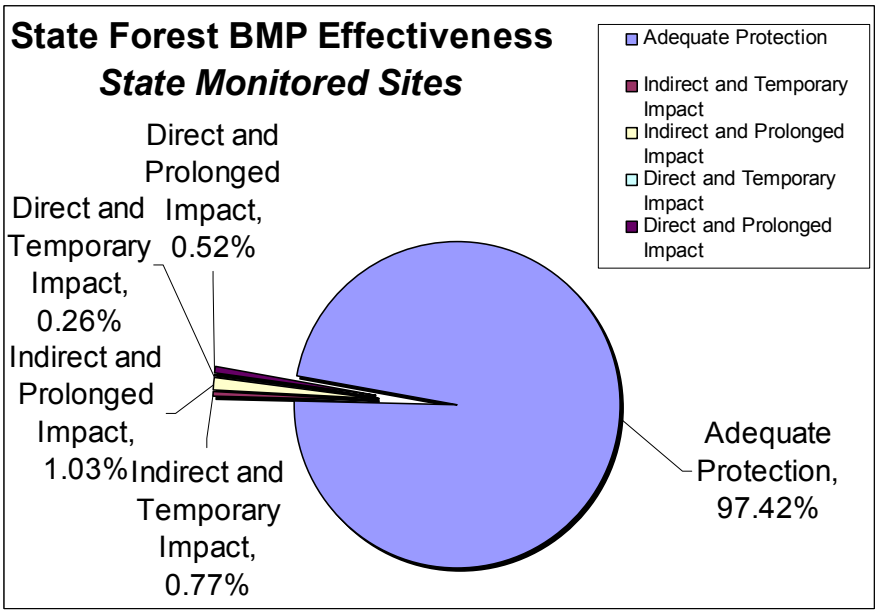

Figure 3a: State Forest BMP effectiveness %s for the nine sites monitored by state personnel.

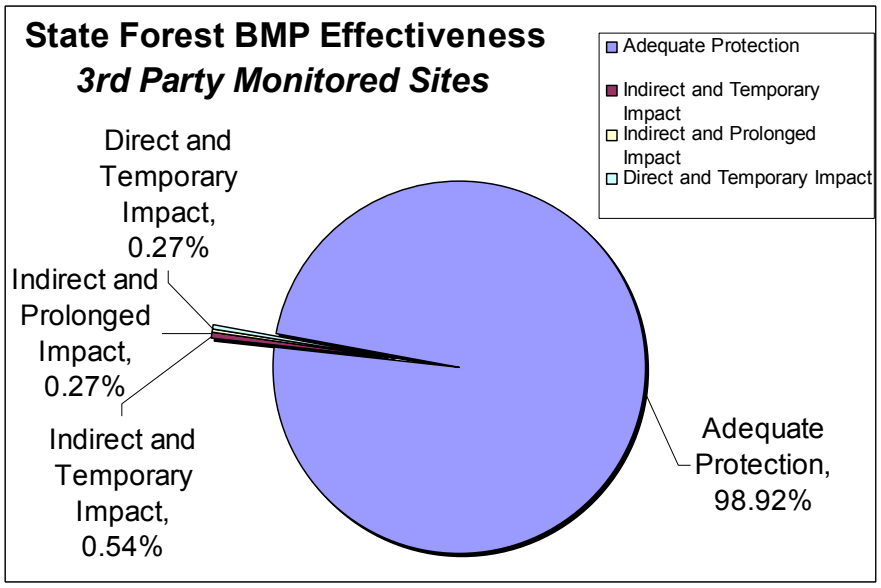

Figure 3b: State Forest BMP effectiveness %s for the nine sites monitored by the 2008 third-party audit team.

II. Acknowledgments

The Division of Forestry thanks Richard Langdon for taking time from his small business; Barbara Wilhoit for her time and effort, and Foley Hardwoods for allowing her to participate; and Allen Pursells, Barry Wilson and The Nature Conservancy for their help with this project.

III. Introduction

Indiana contains 4.5 million acres of forestland that provides many benefits to all of Indiana's people and wildlife. The State Forest system owns only 3.3% or 149,553 acres of Indiana's forestland; however, this land is important to many Hoosiers who frequently use these properties for recreation such as hiking, biking, hunting, fishing and wildlife watching. Since State Forest lands are important to the public, it is imperative that harvesting of State Forests is done in a way that reduces environmental impacts as much as possible. Although forests are extremely effective in reducing nonpoint source pollution (NPS) to waterways, they also can be a source of pollutants. When forest soils are bared, NPS pollution can occur. Forestry BMPs are employed to reduce or eliminate impacts that harvesting can have on forest soils and water quality. BMPs are a foundation for water- quality protection and guidelines for protecting water quality during forest operations. The purpose of BMPs is to minimize the impact of forest activities that may affect soil and water quality.

This report compares BMP monitoring results from DoF employees and a third-party monitoring group at the same nine sites. The intent is to determine if there is consistency between the internal and external monitors in order to assure the public that the State Forest lands are being adequately managed to reduce soil and water impacts during and after timber harvests.

From July 1999 to winter 2003, BMP monitoring on State Forests was conducted with the Watershed Conservation (WC) Forester and/or the License Timber Buyer (LTB) Forester from the special programs section of the DoF, the Administering Forester of the timber harvest being monitored, an Administering Forester from another property, and the Property Specialist that administered the timber harvest program. The Property Specialist stopped coordinating the monitoring and participating in the monitoring of sites late in 2003. In October 2004, the DoF started to change the monitoring system to a sampling method, but was transitioning the system when a change in leadership halted the monitoring until new leadership was put in place. At that time, DoF moved back to 100% monitoring. Presently, DoF monitors 100% of the timber harvests after they are completed, but the monitoring team consists of the LTB, and the Administering Forester of the timber harvest being monitored.

The third-party audit needed to cover at least 10% of the sites that were monitored through the regular process in the years 2005, 2006 and 2007. This total was determined to be three sites from each year. The site-selection process is described later and labeled as such. The basic data on the front page of the monitoring sheet, such as the location and time of the harvest, minus data that could bias the monitoring of the group such as that of the logger and forester, was given to the monitoring team. Its members monitored the sites as described in the Monitoring Process section. The division's LTB forester coordinated the efforts of

the third-party auditing team. The division's property personnel were not informed of the sites or locations where the monitoring was to be done.

BMP monitoring is a site evaluation based on the Indiana Logging and Forestry Best Management Practices: BMP Field Guide (BMP Field Guide) and Indiana's Forestry BMP Monitoring Worksheet. Fifty-eight BMP specifications are evaluated under the five forestry operation categories: 1) forest access roads, 2) log landings, 3) skid trails, 4) stream crossings, and 5) riparian management zones. Each BMP specification is rated for application of the BMP and effectiveness in protecting water quality. Seven general questions are posed about the root of the site's noted failures and successes. The evaluation also records other land uses on the site that could affect water quality.

IV. Methods

A. Third-Party BMP Monitoring Objectives

The objectives of BMP monitoring are: 1) to assess the effectiveness of the BMP guidelines in minimizing soil erosion and stream sedimentation, 2) provide information on the extent of BMP implementation, past and current, 3) identify areas to focus future program training and educational efforts to improve BMP implementation and effectiveness, 4) identify BMP specifications that may need technical modification, 5) identify improvements needed in future monitoring efforts, and 6) determine if internal monitoring is being implemented and reported in a consistent, truthful and environmentally significant way.

B. Monitoring Team Selection

For State Forest properties, DoF tries to have the WC and LTB foresters come to every BMP monitoring; however, at many sites, one or the other was absent for either personal or professional reasons. Monitoring still continued, helping maintain a balance between being consistent and keeping production of results on schedule.

The other participants were the Administering Forester and an Administering Forester from another property. This balanced the team for input in site evaluation of the monitoring process and provided good training and discussion.

From July 1999 until 2003, the coordination of monitoring dates and people was carried out by the Property Specialist, who also would attend the monitoring of every timber harvest. This practice was discontinued when administrative duties increased for that position and the coordination of the monitoring was passed to the WC forester.

The third party needed to have at least three people who could take the time to visit the nine sites together. The team represented an array of interested parties from outside state government. Richard Langdon, a private landowner, has participated in the BMP monitoring program since its inception in 1997. Allen Pursells and Barry Wilson are foresters from The Nature Conservancy, with no past Indiana Forestry BMP monitoring experience. Barbara Wilhoit is a forester for Foley Hardwoods. She has participated in BMP monitoring in past rounds.

C. Site Selection

It was determined that 10% of sites monitored in 2005, 2006 and 2007 would be remonitored for quality-control purposes. Sites were given numbers, then numbers were chosen randomly. The six sites from 2005 and 2006 were monitored during a two-week period in 2007. Three sites, 10% of sites monitored in 2007, also were audited in a two-day period in October 2008.
The three sites randomly chosen for this audit from those monitored internally in 2005 were Clark State Forest Compartment 18 Tracts 2 and 6 (C18T2+6), Yellowwood State Forest C14T6 and Owen State Forest C9T1.

The three sites chosen for this audit from those monitored internally in 2006 were Clark State Forest C5T7, Jackson-Washington State Forest C1T2, and Morgan-Monroe State Forest C18T7.

The three randomly chosen sites for this audit from those monitored in 2007 were Greene-Sullivan State Forest C4T4, Martin State Forest C2T1 and Ferdinand State Forest C5T4.

D. Monitoring Process

BMP monitoring is based on the evaluation of each specific practice for application and effectiveness. Application is the installation of a practice and the condition of the practice at the time of monitoring. Effectiveness is the level of success a practice has in the prevention of pollutants entering a water body or the level of impact the pollutant is having on the water body at the time of monitoring. It is possible to apply all of the BMPs properly and get a good score in application, but still have soil entering a stream, which would call for a lower score in effectiveness. The opposite also may be possible.

The monitoring on State Forest properties follows the same format as that for all other forestry BMP monitoring in Indiana, except that the team of monitors is made up of people from similar backgrounds. On any monitoring day, the team meets at the forest office and then goes to the field to conduct the BMP monitoring on a harvest that is already completed and closed. The team walks each part of the harvest area, covering all of the access roads, inspecting the log landings, skid trails, riparian management zones, and stream crossings as suggested in the Indiana BMP Monitoring Protocol, and comments on successes and departures from the BMP guidelines. Also, the WC or the LTB forester walks all of the intermittent or larger streams in or adjacent to the timber harvest area.

Once on the site, the State Forest monitoring team walks the area and its adjacent and interior intermittent or larger streams while carrying maps of the site, the BMP monitoring form and the BMP Field Guide. This time allows each team member to individually evaluate the BMPs on the site. Once they have walked most of the area, team members meet at the vehicle or another gathering place to discuss each question on the BMP monitoring form until they reach consensus. This process also was followed by the third-party audit team.

On State Forest properties, the definition of intermittent streams focuses on streams that are 4 feet wide at the bed of the stream or marked as mapped intermittent streams on USGS quadrangle maps. This allows for easier determination of which streams need to be monitored for stream crossings and which need to have the large woody debris caused by the harvest removed. A better history and definition for streams that qualified as being 4 feet wide is in Appendix A of this report.

V. Results

A. Overall Application and Effectiveness

State monitors and third-party auditors were in accord on the overall application of forestry BMPs with rates of 91.75% and 92.18%, respectively (Figure 1a). State BMP monitors found 32 (8.25%) minor departures in BMP application (Figure 2a). Third-party monitors found 27 (7.28%) minor departures and two (0.54%) major departures in application (Figure 2b). The two major departures were for lack of traffic barriers on an access road and excavated material in an ephemeral channel.

BMP effectiveness between the two groups was not as close as application but still had minimal deviation. State employees scored the BMPs as having a 97.42% overall effectiveness and the third-party group scored overall effectiveness as 98.92% (Figure 1b). The state monitors scored the effectiveness of the BMPs audited 1.5% lower than did the third-party auditors.

B. BMPs by Category

1. Access Roads

Access roads were considered to be implemented correctly 93.3% of the time by the state monitors while the third-party auditors determined they were applied correctly 95.7% of the time. State monitors determined that the BMPs in place were 96.7% effective in protecting the soil and water resources of the site. Third-party auditors rated the access road BMPs as 99.14% effective.

Table 1: Application and effectiveness of BMP specifications for access roads.

Access Roads	% Application State Monitored	% Application Third-party Monitored	% Effetive State Monitored	% Effective Third-party Monitored
A1. Uses existing routes where appropriate	100	100	100	100
A2. Adequate buffer strip next to watercourses and sensitive areas	87.5	100	100	100
A3. Avoids unstable gullies, seeps, very poorly drained areas	100	100	100	100
A4. Road grades are within standards	100	100	100	100
A5. Amount of roads minimized	100	100	100	100
A6. Stream crossings minimized	100	100	100	100
A7. Road excavation minimized	100	100	100	100
A8. Excavated and fill materials placed properly	100	100	100	100
A9. Roads constructed to drain well	75	87.5	100	100
A10. Appropriate road stabilization, drainage and diversions installed	100	100	100	100
A11. Water diversions functioning properly	75	85.7	75	100

A12. Runoff diverted onto stable forest floor areas	75	85.7	75	100
A13. Public road drainage system maintained	100	100	100	87.5
A14. Public road's drainage maintained	100	100	100	100
A15. Traffic barriers installed	87.5	75	100	100
Overall Access Road	93.3	95.7	96.7	99.1

Both parties agreed that the access roads could have been constructed to drain better, state monitors giving a 75% application rate in this area and third-party monitors scoring 87.5%; however, both parties said this departure in application had no negative effect on soil and water quality. The third-party group gave a major application departure to one site for the lack of a traffic barrier. No negative effects to the soil and water resources of the site were detected due to this departure. Access roads are often permanent fire trails or other roads that are used and maintained to varying degrees, thus some are more structurally stable than others that have had the diversions worn down by use over long periods.

2. Log Landings

State monitors found the overall Log Landing BMP application to be 92.1% and third-party monitors scored this category at a 95.5% application rate. Both parties determined that all BMPs were 100% effective in protecting soil and water resources of the sites.

Table 2: Application and effectiveness of the BMP specifications for log landings.

Log Landings	**% Application State Monitored**	**% Application Third-Party Monitored**	**% Effective State Monitored**	**% Effective Third-Party Monitored**
Y1. Suitable number and size of landings	100	100	100	100
Y2. Landings located outside RMZ	100	100	100	100
Y3. Landings located on stable areas	88.9	100	100	100
Y4. Excavation of site minimized	100	100	100	100
Y5. Landings avoid concentrating or collecting runoff	66.7	100	100	100
Y6. Landing's runoff enters stable area	77.8	77.8	100	100
Y7. Proper water diversions in working order	100	87.5	100	100
Y8. Landing smoothed and soil stabilized	100	88.9	100	100
Y9. Landings free of fuel and lubricant spills and litter	88.9	100	100	100
Y10. Landing location suitable for equipment fueling and maintenance	100	100	100	100
Overall Log Landings	92.1	95.5	100	100

The state monitors saw problems in two sites with landings collecting runoff. The third-party monitors did not see this problem and gave a 100% rating to this specification. The explanation for this is probably due to the very dry conditions in 2007, thus little to no standing water was seen in the landing areas. Landing runoff entering stable areas had a deviation between monitoring groups on application score; state monitors recorded only one of these sites as having problems, while the third-party group recorded two sites having this issue. All application departures showed no impact on the water resources of the sites since there was 100% compliance with BMP effectiveness specifications.

3. Skid Trails

State monitors found skid trail BMP effectiveness to be 85.4% while third-party monitors found it to be 81.9%. The state monitors recorded 95.5% effectiveness of BMPs in this category and the third-party group determined skid trail BMPs to be 100% effective in maintaining soil and water integrity.

Table 3: Application and effectiveness of BMP specifications for skid trails.

Skid Trails	% Application State Monitored	% Application Third-Party Monitored	% Effective State Monitored	% Effective Third-Party Monitored
S1. Uses existing routes were appropriate	100	100	100	100
S2. Adequate buffer strip next to water courses and sensitive areas	100	77.8	100	100
S3. Avoids steep and long straight grades (>20% for >200')	87.5	100	100	100
S4. Avoids unstable gullies, seeps, poorly drained areas	77.8	88.9	100	100
S5. Amount of skid trails minimized	66.7	66.7	100	100
S6. Trail excavation minimized	100	88.9	100	100
S7. Appropriate drainage and diversions installed	77.8	62.5	88.9	100
S8. Water diversions in working order	88.9	50	88.9	100
S9. Runoff diverted onto stable forest floor areas	77.8	87.5	88.9	100
S10. Streams not used as skid trails (except for crossings)	77.8	100	88.9	100
Overall Skid Trail	85.4	81.9	95.5	100

Third-party monitors determined that two sites had areas where there were not adequate buffers next to streams and other sensitive areas. State monitors, however, scored 100% application compliance in this area. Other specifications were comparably scored, except for the last two, where the state monitors determined that two sites were deficient in BMP application. These same sites' BMPs were given a 100% application rate by the third-party monitors.

4. Stream Crossings

State monitors found 100% stream crossing BMP application for the three sites with a crossing. Third-party monitors gave a 96.7% BMP application rate to the three sites. Both groups determined that there was no negative effect upon the soil and water resources of the sites and thus gave a 100% BMP effectiveness rate.

Table 4: Application and effectiveness of BMP specifications for stream crossings.

Stream Crossing	% Application State Monitored	% Application Third-Party Monitored	% Effective State Monitored	% Effective Third-Party Monitored
X1. Number of crossings minimized	100	100	100	100
X2. Crossings minimize disturbance to the natural bed and banks	100	66.7	100	100
X3. Stream bank approaches properly designed and stabilized	100	100	100	100
X4. Water runoff diverted from road prior to crossing	100	100	100	100
X5. Crossing as close to 90 degrees as practicable	100	100	100	100

X6. Crossing does not unduly restrict water flow	100	100	100	100
X7. Soil has not been used as fill in the stream (except culverts)	100	100	100	100
X8. Ford constructed of non-erosive materials	100	100	100	100
X9. Fords have stable banks and stream beds	100	100	100	100
X10. Culverts are properly sized and installed	100	100	100	100
X11. Culverts clear of significant flow obstructions	100	100	100	100
X12. Temporary structures properly anchored	N/A	N/A	N/A	N/A
X13. Temporary structures and resulting obstructions removed	N/A	N/A	N/A	N/A
Stream Crossing	100	96.7	100	100

There was only one departure in application and effectiveness for all the specifications in this category. This was a minor departure of the crossing minimizing disturbance to the natural bed and banks as determined by the third-party group. They determined that this departure had no negative effect upon the soil and water resources of the site.

Since stream crossings deal directly with intermittent streams, that is defined on state properties as 4-foot or wider streams, often state properties have stream crossings where many other property ownership types in the past would have been classified as ephemeral crossings.

5. Riparian Management Zones

State monitors gave RMZ BMP application a rating of 93.4%, while the third-party monitors gave a rating of 92.6%. RMZ effectiveness was given a 96.8% by state monitors and 94.4% from third-party auditors. This is the only category where the third-party group gave a somewhat lower overall score in application and effectiveness than the state group did.

Table 5: Application and Effectiveness of BMP Specifications for Riparian Management Zones.

Riparian Management Zones	**% Application State Monitored**	**% Application Third-Party Monitored**	**% Effective State Monitored**	**% Effective Third-Party Monitored**
Z2. Perennial & large intermittent streams clear of obstructing debris	71.4	85.7	71.4	85.7
Z3. Treetops and cutoffs placed back from water course to prevent movement into streams during floods	100	100	100	100
Z4. RMZ free of excavated material & debris (other than above)	100	100	100	100
Z5. Less than 10% bare mineral soil exposed within RMZ (not including crossings)	100	100	100	100
Z6. Adequate tree stocking in primary RMZ next to perennial streams	100	100	100	100
Z7. RMZ free of roads and landings (except crossing)	71.4	85.7	100	100
Z8. Water diverted from roads before entering RMZ	100	100	100	100
Z9. Water diverted onto stable areas of the forest floor	100	100	100	100
Z10. Road and trail surfaces stabilized as needed within RMZ	100	100	100	100
Z11. Ephemeral channels free of excavated material	100	71.4	100	71.4
Riparian Management Zones	93.4	92.6	96.8	94.4

Interestingly, there was a discrepancy between groups as to the existence of an RMZ on one site. The third-party monitors showed no RMZ on one site for which the state group determined there was one present. Obstructing debris in perennial and large intermittent streams was considered a problem at one site by both groups. State monitors gave a 71.4% in application and effectiveness for this specification while the third-party monitors scored it at 85.7% for application and effectiveness. Both groups determined that there were landings and roads that were in the RMZ, but showed no detrimental effects to the soil and water quality of the sites affected. There was divergence between the two groups on excavated material in the ephemeral channels. The third-party auditors scored the application and effectiveness in this area as 71.4%, while the state monitors gave application and effectiveness a rating of 100%. This significant difference was due to a salvage harvest that happened on the same site between the state's internal monitoring (Dec. 6, 2006) and the third-party audit (July 10, 2007).

6. Overall Site Ratings

At the conclusion of each site evaluation monitors are asked to give a rating of the application and effectiveness of BMPs at the site. Ratings for application and effectiveness can range from 1 to 4. Monitors are welcome to use integers or non-integers. Ratings for application of BMPs: 1= above average, 2= average, 3= poor, 4= total negligence. Ratings for effectiveness or overall impact to water quality are: 1= no visible impact, 2= slight impact, 3= moderate impact, 4= severe impact. The ratings given by each monitor are then averaged to give an overall application and effectiveness rating for each site. The overall ratings for application and effectiveness are then summed and divided by two to determine the overall site rating (Table 6). It is important to note that these numbers do not necessarily directly reflect the worksheet ratings for application and effectiveness. This rating is a general impression of each monitor of the overall BMP application and effectiveness of the site.

Table 6: Average Ratings Given to Three Sites Audited by State and Third-Party Monitors

	Ave. Application Rating	Ave. Effectiveness Rating	Ave. Overall Rating
State-Monitored Sites	1.39	1.45	1.42
Third-Party Monitored Sites	1.37	1.11	1.24

VI. Discussion

Overall BMP ratings for the nine randomly selected sites were mostly congruent between the state and third-party monitors. State monitors determined application rates to be 91.75% and third-party monitors scored BMP application at 92.18%, a difference of only 0.43%. The scoring gap between the two groups on effectiveness was a bit larger (1.5%), with the third-party group giving the BMPs a higher rating (98.92%) than the state monitors (97.42%). The lower application rating for each monitoring group corresponds to higher effectiveness rates, showing that, usually, where there are departures in application, there is little negative effect to the soil and water resources at the site.

Access roads application and effectiveness scores are high between both groups. The third-party group scored this category higher than did the state group. State employees scored application and effectiveness for access roads at 93.3% and 95.7%, respectively. The auditing group scored these at 96.7% and 99.1%, respectively.

Log landings also had a high application and effectiveness rate. State monitors gave this category a 92.1%; the third-party monitors, 95.5%. Both monitoring groups determined that log landing BMPs for the nine sites were 100% effective at protecting the soil and water resources of the site.
Skid trails have a somewhat lower application score than the other categories. State monitors determined that skid trail BMPs were correctly applied 85.4% of the time. Third- party monitors determined the application rate to be 81.9%. Skid trails can have a spectrum of disturbance levels depending on the amount of times the equipment drives over a particular point on the ground. For instance, the main trail just off the landing would have a higher disturbance level because all of the harvested logs have to be moved to the landing, where an area that is traveled over only twice, once to get to access logs and the other to pull out the logs, has a much lower level of disturbance. Also, skid trails go to areas that other equipment cannot access, so they may cross drainages, travel down or across hill slopes, or go into areas that are wet most of the time; therefore, most of the application and effectiveness issues of a site are from skid trails. Also, most of the closeout practices are put in place with limited space as landforms and adjacent vegetation will often limit the equipment's ability to place structures where they would be most effective. This causes minor departures with little to no effect on water quality. The good news is that even with the relatively low applications scores on skid trials, the effectiveness remained high. At these nine sites the departures in application had little negative effect upon the resources of the site. State monitors gave the skid trail BMPs a 95.5% effectiveness rate; third-party monitors gave a 100%.

Stream crossings are the BMP category that must be handled with a lot of care. Departures in this area could lead to pollution being directly deposited into a water body.
Of the six sites chosen for this comparison study, only three had stream crossings. There was only one departure in application and effectiveness at these three stream crossings. The third-party group determined that there was a minor departure in the crossing minimizing the disturbance to the natural bed and stream banks. All other BMPs were determined to be applied correctly and performing as expected.

Riparian Management Zone BMP departures also can have a direct negative impact upon the water bodies of a site. There seemed to be less consistency between the two groups on this category. The third-party group scored application and effectiveness of RMZ BMPs lower than did the state, with a 92.6% application and 94.4% effectiveness rating. The state monitors scored RMZ application at 93.4% while the effectiveness rate was 96.8%. Part of this discrepancy between groups could be explained by a misunderstanding of the definition of a riparian management zone. The state group determined that one site had a RMZ while the third-party group did not recognize this area as having an RMZ. More of this divergence also could be explained by the salvage harvest activity that occurred on one site between the state and third-party monitoring.

VII. Recommendations

Concentrate on areas where problems are more common, such as skid trails, RMZs, and stream crossings.
Continue to emphasize importance of diverting water before it concentrates on roads, landings, skid trails and enters streams and RMZs.
Continue providing BMP educational information and programs for loggers and resource professionals who work on state properties. If there is an area of concern on state properties, focus training on that area.

VIII. Conclusions

The Indiana Forestry BMP Guidelines are scrutinized and enforced on State Forest properties more than on any other landowner category in the state of Indiana. When the internal inspections began, the application scores actually dropped due to the standards on the State Forest properties like the 4-foot rule being raised by regulations; however, effectiveness in protecting water quality, which is the main goal of Indiana's Forestry BMPs, has always been high and continued as such at the time of this report. The consistency between the state and third-party monitors confirms that the DoF is both implementing and monitoring State Forest BMPs in an acceptable and reliable manner.

Our State Forest system has diverse usage. It is the responsibility of the DoF to ensure that all of the forest users have a minimal impact upon the other resources of the forests. Forestry BMPs are the means by which soil erosion from harvesting areas is minimized. Minimal soil erosion allows for quick recovery of the site because the topsoil is still in place to allow for natural succession to take place. Limited sedimentation to the water resources of the forest protects or restores water quality.

Appendix A

BMP Definition Clarification – 4-Foot Rule

Background

The BMP Field Guide states: "Remove felled tops and logging debris from the channels of perennial and large intermittent streams." On the BMP Monitor Sheet (expanded) the definition of the streams is further defined as "… wider than 6'…" The purpose of this is to identify a specified width *for monitoring purposes*, rather than using a vague descriptive term (e.g., "large intermittent"). Readers should realize that BMPs are guidelines—in some instances, even a 6-foot width may not be "large;" in others, streams narrower than 6 feet may be considered "large" from a hydrological standpoint. Foresters therefore are expected to interpret the local hydrology and make on-site determinations when applying BMPs. This is clearly true for this BMP standard.

At the start of BMP monitoring on State Forests, DoF tried to adhere to a tighter standard for streams on State Forests—hence, the 4-foot standard for large intermittent streams. This would serve both as a demonstration of commitment to water quality, and as a demonstration and test of a tighter standard.

Variable stream width cropped up as a problem early in this process, requiring clarification of stream width. Streams would widen to more than 4 feet then narrow to less than 4 feet. This created a burden of trying to find the last point upstream at which a stream was 4 feet wide. To solve this, DoF decided that to meet the 4-foot rule, a stream had to be consistently 4 feet wide or wider. This solved some but not all concerns. Examples of unsolved concerns were what debris needs to be removed and how best to determine where a stream is consistently 4 feet wide or wider.

The latest attempt to clarify the 4-foot rule follows. This clarification covers both the definition of the stream and of what debris needs to be removed.

Removing Logging Debris from Streams – 4-Foot Rule

To meet the BMP Field Guide guidelines for riparian zones that states "Remove felled tops and logging debris from the channels of perennial and large intermittent streams," the BMP Monitor Sheet has Item Z2 "Perennial & large intermittent streams clear of obstructing debris." On State Forests, all streams that are to meet this standard will have a clearly defined bed with a width that equals or exceeds 4 feet.

The bed is that portion of the stream that is the lowest level where water commonly flows at typical (i.e., not storm) levels. This will generally be at the base of the banks and will usually consist of aggregate or exposed alluvium. The bed will generally be free of any significant vegetation because of the regular scouring and water flows. An area with a strong, well-rooted vegetative component with a relatively stable soil surface will not be considered stream bed. In streams where the channel is strewn with large rocks, the bed will be the area of smaller gravel at the base of the large rocks.

The stream will be considered 4 feet or wider until the bed, moving upstream, reaches the first point where the stream-bed width drops below 4 feet for a lineal distance of 10 feet or more. Any portion of the drainage system upstream of this point will not be subject to the debris-removal guidelines for large intermittent streams, and debris left in these portions of the drainage will not be considered a departure during monitoring.

Downstream of the identified 4-foot-wide point, all logging debris, except as noted later, that will come in contact with the water when the stream is "bank full," and impede or divert stream flow, must be removed from the stream channel. Unattached, individual pieces of debris, less than 2 inches in diameter or less than 4 feet in length will not ordinarily impede flow and do not need to be removed. Debris that bridges the stream channel from top of bank to top of bank, does not impede flow, and is unlikely to fall into the stream channel within one year is not required to be removed. Debris less than 2 inches in diameter obstructing less than 20% of the stream channel does not need to be removed.

Debris removal is to be accomplished in a manner that minimizes disturbance to the stream banks. The recommended method of removal is pulling the material free of the channel using a cable skidder or other equipment that is kept back from the stream edges. Another option is to cut debris into smaller pieces that can be removed from the channel or that would no longer impede flow. Equipment should not be used in the stream channel to push the material out of the channel. Careful marking of the trees to be harvested, use of directional felling, and clearly explaining the BMP requirements during the pre-harvest conference will minimize the amount of debris that must be removed from stream channels.

The point where the stream channel reaches the 4-foot width threshold should be clearly delineated in harvest areas. While upstream of this point will not be considered subject to debris removal from streams, care should be taken to avoid excessive, intentional deposition of debris in all naturally occurring drainage features, regardless of size. Excessive piling (beyond felling) of debris in any drainage that severely impedes flow may be considered a departure.

Appendix B
FORESTRY BMP MONITORING WORKSHEET
(2000)

DATE INSPECTED:_____TEAM:_____
OWNER: _____ PHONE:_____.
_____
_____

COUNTY:_____SITE #:_____ ACRES HARVEST-
ED:_____
CIVIL TWP:_____ USGS QUAD:_____
SEC:_____TWP:_____ RANGE:_____
MAJOR WATERSHED:_____
DATE OF ACTIVITY:_____
HARVEST EQUIPMENT USED: Dozer:__ Skidder:__ Horses:__ Other:__
TYPE OF HARVEST: Diameter limit:__ Single Tree:__ Group Selection:__ Clear Cut:__ Other:__

SITE CONDITIONS

TERRAIN: BOTTOMLAND_____% RIDGES_____% SIDE SLOPES_____%
SLOPE STEEPNESS: (2-6%)_____ (6-12%)_____ (12-20%)_____ (20+%)_____
LAKES PRESENT: name:_____shore length:_____
PERENNIAL STREAMS PRESENT: name:_____width:_____length:_____
SINKHOLES PRESENT: Yes_____ No_____ FLOWING SPRINGS PRESENT: Yes_____ No_____
OPEN WATER WETLANDS PRESENT: Yes_____ No_____ .

FOR OFFICE USE – DO NOT COMPLETE

OPERATOR/FORESTER: (leave blank)_____

TYPE OF OWNERSHIP: nipf:__ clf:__ industry:__ state:__ fed:__ county:__ other:__

APPLICATION
0--The Practice Not Needed or Applied on Site
1--Operation Meets Requirement of BMP
2--Minor Departure from BMP
3--Major Departure from BMP
4--Gross Neglect of BMP

EFFECTIVENESS
1--Adequate Protection of Water Resources.
2--Indirect and Temporary Impacts on Water Resources.
3--Indirect and Prolonged Impacts on Water Resources.
4--Direct and Temporary Impacts on Water Resources.
5--Direct and Prolonged Impacts on Water Resources.

APPLICATION DEFINITIONS (BY EXAMPLE)
MINOR DEPARTURE: Practice not clearly needed; attempted practice but poorly applied; small potential for soil to reach streams.
MAJOR DEPARTURE: Practice clearly needed; common departures from practice; large potential for soil to reach streams.
GROSS NEGLECT: No attempt at application; total disregard for water quality; large and direct impacts.

EFFECTIVENESS DEFINITIONS (BY EXAMPLE)
ADEQUATE: Small amount of material eroded; material does not reach drainages, streams, lakes or sinkhole openings.
INDIRECT IMPACT: Erosion and delivery of material to drainages (including ephemerals) but not to intermittent or perennial streams, lakes or sinkhole openings.
DIRECT IMPACT: Erosion and subsequent delivery of sediment to intermittent or perennial streams, lakes or sinkhole openings.
TEMPORARY IMPACT: Impacts lasting one year or less; no more than one runoff season; small amount of material involved.
PROLONGED IMPACT: Impacts lasting more than one year; large amount of material involved.

*It is possible to have a departure from BMPs and still have adequate protection.

ACCESS ROADS							APPLICATION (0-4)		
								EFFECTIVENESS (1-5)	
									COMMENTS
There is no access road present _____ (If true, do not answer questions below)									
A1. Uses existing routes where appropriate									
A2. Adequate buffer strip next to watercourses and sensitive areas									
A3. Avoids unstable gullies, seeps, very poorly drained areas									
A4. Road grades are within standards									
A5. Amount of roads minimized									
A6. Stream crossings minimized									
A7. Road excavation minimized									
A8. Excavated and fill materials placed appropriately									
A9. Roads constructed to drain well									
A10. Appropriate road stabilization, drainage & diversions installed									
X=applied	**water bars_____ dips/rolls_____ outslopes_____ berms cut_____ culverts____ geotextile____ rock____ seed____ mulch____**								
A11. Water diversions are in working order (_____% working) **Failure due to: installation, damage, location, timing, weather, other**									
A12. Runoff diverted onto stable forest floor areas									
A13. Mud kept off public roadways									
A14. Public road drainage system maintained									
A15. Appropriate traffic barriers installed									

APPLICATION
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LOG LANDINGS									
							APPLICATION (0-4)		
								EFFECTIVENESS (1-5)	
									COMMENTS
Y1. Suitable number and size of landings									
Y2. Landings located outside RMZ									
Y3. Landings located on stable areas									
Y4. Excavation of site minimized									
Y5. Landings avoid concentrating or collecting runoff									
Y6. Landing's runoff enters stable area									
Y7. Proper water diversions in working order									
Y8. Landing smoothed and soil stabilized									
Y9. Landings free of fuel and lubricant spills and litter									
Y10. Landing location suitable for equipment fueling and maintenance									
Number of log landings _____ Size: (acres) _____									

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SKID TRAILS												
								APPLICATION (0-4)				
									EFFECTIVENESS (1-5)			
										COMMENTS		
S1. Uses existing routes where appropriate												
S2. Adequate buffer strip next to watercourses & sensitive areas												
S3. Avoids steep and long straight grades (>20% for >200')												
S4. Avoids unstable gullies, seeps, poorly drained areas												
S5. Amount of skid trails minimized												
S6. Trail excavation minimized												
S7. Appropriate drainage and diversions installed												
X= applied	water bars____ outslopes____ dips/rolls____ berms cut____ culverts____ seed____ mulch____ rock____ other____											
S8. Water diversions in working order (_____% working) Failure due to: installation, damage, location, timing, weather, other												
S9. Runoff diverted onto stable forest floor areas												
S10. Streams not used as skid trails (except crossings)												
Types of streams involved and length of disturbance: perennial_____ , mapped intermittent_____. Unmapped intermittent_____ , ephemeral_____.												

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STREAM CROSSINGS					
			APPLICATION (0-4)		
				EFFECTIVENESS (1-5)	
					COMMENTS
X1. Number of crossings minimized					
X2. Crossings minimize disturbance to the natural bed & banks					
X3. Streambank approaches properly designed and stabilized					
X4. Water runoff diverted from road prior to crossing					
X5. Crossing as close to 90 degree angle as practicable					
X6. Crossing does not unduly restrict water flow					
X7. Soil has not been used as fill in the stream (except culverts)					
X8. Ford constructed of non-erosive materials that will not degrade water quality					
X9. Fords have stable banks and streambed					
X10. Culverts are properly sized and installed					
X11. Culverts clear of significant flow obstructions					
X12. Temporary structures properly anchored					
X13. Temporary structures and resulting obstructions removed					
Number of perennial crossings_____ widths_____. **Number of intermittent crossings_____ widths_____ Number of unmapped intermittents_____ widths__.**					

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RIPARIAN MANAGEMENT ZONES			
	APPLICATION (0-4)		
		EFFECTIVENESS (1-5)	
			COMMENTS
Z1. RMZ present on this site include: _____ lakes, _____ rivers, _____ perennial streams, _____ intermittent streams, _____ sinkhole openings (specify), _____ open water wetlands, _____ unmapped intermittent streams			
Z2. Perennial & large intermittent streams clear of obstructing logging debris			
Z3. Logging debris placed back from watercourse to prevent movement into streams during floods			
Z4. RMZ free of piled slash, debris and fill			
Z5. Less than 10% bare mineral soil scattered within RMZ - not including crossing			
Z6. Adequate tree stocking in primary RMZ next to perennial streams			
Z7. RMZ free of roads and landings (except crossings) Were roads pre-existing? _____			
Z8. Water diverted from roads before entering RMZ			
Z9. Water diverted onto stable areas of the forest floor			
Z10. Road and trail surfaces stabilized as needed within RMZ			
Z11. Ephemeral channels free of excavated material			

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SUPPLEMENTAL QUESTIONS AND SUMMARY

1) What went right on this site? Please summarize highlights.

2) What went wrong on this site? Please summarize problems.

3) Have other activities occurred on this site that potentially impact water quality (e.g., ATV use, other vehicle traffic, grazing, etc.)? If so, please explain.

4) Were traffic barriers in place to prevent trespass damage? _____.
What kind of trespass damage was observed?

5) Are there mitigating activities that should take place on this site or is corrective action already being taken?

6) -Has the sale administrator received BMP training? Yes_____ No_____Unknown_____
- Has the operator (logger) received any BMP training? Yes_____ No_____Unknown_____
- Was the sale administered by a forester? Yes_____ No_____Unknown_____
- Is the landowner aware of BMPs? Yes_____ No_____Unknown_____

7) Give this site an overall rating of 1-8 combining application of BMPs with impact to water quality.

Rate this site from 1-4 for the overall application of BMPs _____
1=above average 2=average 3=poor 4=total negligence

Rate this site from 1-4 for its overall impact to water quality _____
1= no visible impact 2=slight 3=moderate 4=severe

SITE RATING _____/2=_____

Note: These numbers do no necessarily need to directly reflect the worksheet ratings for application or effectiveness

Field Guide Cross Reference

On this page is each question in the monitoring sheet and the corresponding pages on the subject in the BMP Field Guide.

ACCESS Roads == Section II, pages 8-16

A1 == pages 4, 8, 10
A2 == pages 8, 9, 12, Section V page 32, 33, Table 4 page 34, 35
A3 == page 8
A4 == page 8
A5 == page 10
A6 == page 8 and Section IV page 24 – 30
A7 == pages 8, 10
A8 == pages 10, 12, 24, 29
A9 == pages 8, 10, Table 1 page 11, 12
A10 = pages 8, 10 Table 1 page 11, 12, 14, 15, Table 2 page 21, 22
X=Applied == (waterbars, pages 21-22), (dips/rolls, pages 21-22), (outslopes, Glossary), (berms cut, Glossary),
(culverts, pages 27-28), (geotextile, Glossary), (rock, page 10), (seed, Appendix A), (mulch, Appendix A).
A11 = pages 14, 15, Table 1 page 11, 18, Table 2 page 21
A12 = page 10
A13 = pages 13, 14
A14 = page 14

LOG LANDINGS == Section IV, pages 36-40

Y1 == pages 36, 39
Y2 == Table 4 page 34, 36
Y3 == page 36
Y4 == page 38
Y5 == pages 36, 38-40
Y6 == pages 38-40
Y7 == pages 38-40
Y8 == pages 38-40
Y9 == pages 39, 40
Y10 = page 39

SKID TRAILS == Section III, pages 18-22

S1 == pages 4, 18
S2 == pages 18, 20, Section V pages 32-35
S3 == page 18
S4 == page 18
S5 == page 18
S6 == page 18
S7 == Table 1 page 11, pages 18-20, Table 2 page 21, 22, 27, 28

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(culverts, pages 27-28), (geotextile, Glossary), (rock, page 10), (seed, Appendix A), (mulch, Appendix A).

S8 == Table 1 page 11, pages 14, 15, 20 Table 2 page 21
S9 == page 20
S10 = pages 18-20, Section IV pages 24-30
Types of Streams == page 24, Glossary, and Section V pages 32-35

STREAM CROSSINGS == Section IV, pages 24-30

X1 == page 24
X2 == page 24
X3 == pages 24, 25
X4 == pages 24, 25
X5 == page 24
X6 == pages 24-26, 28
X7 == pages 24, 29
X8 == pages 24, 29
X9 == pages 24, 25, 29
X10 = pages 25, 27, Table 3 page 28
X11 = pages 24, 27, 28
X12 = pages 25, 26
X13 = pages 25-29

RIPARIAN MANAGEMENT ZONES == Section V, pages 32-35

Z1 == pages 32, 34, Glossary
Z2 == page 33
Z3 == pages 32-34
Z4 == pages 32-34
Z5 == pages 32-34
Z6 == pages 32-34
Z7 == pages 32, 34
Z8 == pages 33, 34
Z9 == pages 32-34
Z10 = pages 33, 34
Z11 = page 35