Implementation of Forestry Best Management Practices in Eastern Oklahoma

Results of 2004-2006
BMP Implementation Monitoring

Oklahoma Department of Agriculture, Food and Forestry
Forestry Services Division

September 2007

Implementation of Forestry Best Management Practices in Eastern Oklahoma

Results of 2004-2006 BMP Implementation Monitoring

by

Darryl Hunkapillar, Water Quality Forester
Kurt Atkinson, Assistant Director

John Burwell, Director
Oklahoma Department of Agriculture, Food and Forestry
Forestry Services Division

This publication was developed and published by the Oklahoma Department of Agriculture, Food and Forestry, Forestry Services Division, as authorized by John Burwell, Director and Terry Peach, Secretary of Agriculture. 200 copies were printed at a cost of $500. Copies have been deposited with the Publications Clearinghouse of the Oklahoma Department of Libraries (9/2007).

EXECUTIVE SUMMARY

Oklahoma's Forest Water Quality Program completed the second evaluation of the level of implementation of the State's non-regulatory Forestry Best Management Practice (BMP) Guidelines. A total of 100 sites on which silvicultural activities had occurred within two years of the field check were evaluated. Sample sites were selected randomly from a pool of nearly 800 tracts, and are considered to be representative of the forestry activities that occur throughout eastern Oklahoma. The data collection took place from August 2004 through May 2006. Each tract received an on-site visit and the BMPs were evaluated against a standard checklist to determine whether they were implemented or not.

Overall BMP implementation on the sites monitored was 91.6%, which represents a slight increase from the 90.5% rate in the 2003-2004 monitoring period. In general, implementation was highest on sites under public or forest industry ownership. National Forest sites had an overall implementation rate of 96.8%, while forest industry sites had a 95.4% implementation rate. Non-industrial private forestlands rated 89.4% overall.

BMP implementation was statistically higher on sites when:

- a professional forester was involved
- the activity was supervised by the landowner
- the landowner and logger were familiar with the BMPs
- the logger had attended a BMP workshop
- BMPs had been included in the timber sale contract
- the landowner was a member of a forestry-related organization

BMP implementation was generally lowest on sites when:

- the land was owned by a non-industrial private landowner, especially an absentee
- the landowner was not familiar with the BMPs and did not supervise the activity
- BMPs were not included in the timber sale contract

Major deficiencies noted during the evaluations were:

- lack of drainage structures on skid trails and temporary roads
- drainage and stability problems on some permanent roads
- lack of restoration of stream crossings on temporary roads

Significant observations were:

- roads of all kinds need increased focus
- streamside management zone BMPs have a high level of implementation
- landings do not pose a serious problem
- very few significant risks to water quality were observed

Information from this project will be used to modify, as needed, Oklahoma's Forestry BMPs, and will serve as a baseline for ongoing BMP monitoring efforts. The project results will also be used to strengthen and better focus ongoing education and technical assistance efforts.

ACKNOWLEDGMENTS

Forestry Services gratefully acknowledges the assistance of Dr. Ron McNew, University of Arkansas, for his guidance in the performance of the statistical analyses used in the report.

Forestry Services also is grateful for the cooperation of landowners, land managers and loggers who provided access to the sample sites and contributed information toward the successful completion of the project.

TABLE OF CONTENTS

Background and Objectives 1

Methods 2
- The BMP Committee 2
- Monitoring Personnel 2
- The Monitoring Checklist 2
- Establishing the Monitoring Pool 3
- Selection of Implementation Monitoring Sites 3
- Data Collection 4
- Summary and Data Analysis 5

Results 5
- Site Characteristics 7
- Roads 7
- Permanent Roads 8
- Skid Trails and Temporary Roads 10
- Stream Crossings 11
- Streamside Management Zones 14
- Site Preparation 16
- Landings 18
- Wetlands 19

Implementation by Site Characteristics 20
- Ownership 20
- Type of Activity 20
- Region 20
- Terrain 21
- Erodibility Hazard 21
- Distance to Permanent Water 21

Statistical Significance 21
- Forester Involvement 22
- Activity Supervised by Landowner 22
- Landowner Familiarity with BMPs 22
- Contractor Familiarity with BMPs 22
- Logger Attended BMP Workshop 22
- BMPs in the Timber Sale Contract 23
- Landowner Membership in Forestry Organizations 23

Overall BMP Implementation 23

Improvement Opportunities 25

Conclusions 25

Next Steps 26

Appendix 27
- Oklahoma BMP Monitoring Checklist 29
- Evaluation Criteria for BMP Monitoring Checklist 33
- Summary of BMP Compliance Monitoring Checklist Data on All Sites 37

BACKGROUND AND OBJECTIVES

The 1972 Clean Water Act (CWA) called for states to establish a program for the development and implementation of Best Management Practices (BMPs) to reduce nonpoint sources of pollution (NPS). Oklahoma's Water Quality Management Program under Section 319(h) of the CWA calls for implementation of BMPs to prevent or otherwise control nonpoint source pollution from forestry operations. The program, described in the Oklahoma Section 319 NPS Management Plan, involves a broad range of activities in education, technical assistance and monitoring to measure BMP effectiveness, including a measure of BMP implementation.

The Oklahoma Department of Agriculture, Food and Forestry (ODAFF) – Forestry Services Division is responsible for the State's silvicultural non-point source pollution program and forestry BMPs, and relies on a non-regulatory system of BMP compliance developed in cooperation with landowners and land users. Oklahoma developed its first forestry BMP guidelines in 1976, and completed an initial compliance-monitoring project in 1978. Since then, Oklahoma's forest water quality program has progressed through initial monitoring of water quality, BMP effectiveness studies, education, demonstration practices, and planning and coordination activities.

Most southern states initiated BMP monitoring in the 1980s or early 1990s. In 1997, the Southern Group of State Foresters developed *Silviculture Best Management Practices Implementation Monitoring, A Framework for State Forestry Agencies*. This document, referred to as the "Southern Monitoring Protocol," provides a framework for monitoring BMP implementation that is statistically sound, objective and technically feasible. It provides direction for and consistency between forestry BMP monitoring efforts in the 13 southern states.

Oklahoma's Forestry BMP Compliance Monitoring project was funded by the State Department of Agriculture, Food & Forestry. No federal funds were used in completion of the project. The project was designed to determine the present use of Oklahoma's non-regulatory forestry BMPs by loggers and landowners during timber harvesting, site preparation and related activities, and to determine whether that use is effective in preventing water quality problems associated with the State's forest lands. Specific objectives of the project were to:

1. Measure the degree of implementation of forestry BMP guidelines by forest landowners, silvicultural contractors, forest industry and government agencies;
2. Evaluate the general effectiveness of BMPs as applied operationally in the field and identify potential problem areas, including roads, stream crossings, streamside management zones and other practices, where Oklahoma's BMPs may need to be refined;
3. Identify specific areas in the State where more intensive logger and landowner information and training efforts might be necessary; and
4. Provide feedback to loggers, landowners, timber buyers and mill owners to help improve silvicultural operations where needed, and to convey to forest industry that its work may be evaluated according to State BMP guidelines.

Forestry Services conducted field data collection between August 2004 and May 2006. This report documents the organization of the project and its major findings.

METHODS

The general approach to BMP monitoring is to establish a large pool of sites that had received silvicultural treatments within two years of monitoring and randomly select enough sites for field evaluation to assure a statistically valid measure of overall BMP performance. The project was designed to be consistent with the Southern Protocol so that the results could be compared with other states in the South. To assure impartiality across a variety of ownerships, the critical issues were: (1) completeness of the pool of potential sites, (2) randomness of the selection of sites to be monitored and (3) thoroughness and consistency of data collection and analysis. Even though no federal funds were involved, data was collected in accordance with the Quality Assurance Project Plan approved by EPA for the 2003-2004 monitoring project.

THE BMP COMMITTEE

To provide general project direction and input into the monitoring checklist and the procedures described below, Forestry Services organized a BMP Committee that initially included forest industry, consulting foresters, loggers, Oklahoma Forestry Association, Oklahoma Conservation Commission and Oklahoma State University. Others subsequently invited to participate included The Nature Conservancy, Water Resources Board, Woodland Owners Association, U.S. Fish and Wildlife Service, U.S. Forest Service, Natural Resources Conservation Service, Oklahoma Farm Bureau, Office of the Secretary of Environment, EPA-Region 6, a non-industrial private forest landowner and a tribal representative.

MONITORING PERSONNEL

Forestry Services' water quality forester completed all site evaluations, assuring greater accuracy and consistency in data collection.

THE MONITORING CHECKLIST

Forestry Services conducted the field evaluations using a BMP Monitoring Checklist and checklist definitions that were identical to those used during the 2003-2004 monitoring project. The Checklist and the Evaluation Criteria are included in the Appendix.

For simplification, each question was worded so that a positive answer was recorded with a "Yes" while a departure from BMP recommendations was answered "No." Some checklist items were not applicable on some sites. If a practice did not apply, the item is shown as "Not Applicable/Not Needed." This allowed a quick determination of any problem areas that were identified during the evaluation. It is important to note that this form (and others like it) has been extensively field tested for consistency and accuracy in representing BMP implementation.

ESTABLISHING THE MONITORING POOL

Commercial forestry activity in Oklahoma is generally concentrated in 18 eastern counties traditionally included in the periodic forest inventory conducted by the U.S. Forest Service. The forest products industry is most active in southeastern Oklahoma where the state's commercial pine forests are located. The industry and its associated infrastructure become less intensive and also less sophisticated as one moves farther north and west from this region.

Typical silvicultural practices with potential for water quality problems if not properly implemented are timber harvesting, including associated activities such as cutting and skidding; landings and loading; hauling and forest road construction and maintenance; site preparation and tree planting; thinning; and pesticide application. To be eligible for monitoring, sites had to have been treated within two years of the field visit.

Requests for site information were sent to forest industry, agency personnel, private forestry consultants, large landowners, the U.S. Forest Service, Tribes, etc. In order to have an ongoing pool from which to randomly select, this information was requested more than once during the project period. In addition to gathering site information as described, courthouse records were also checked for timber deeds that had been filed with the county clerk. This total effort resulted in a pool of nearly 800 sites.

SELECTION OF IMPLEMENTATION MONITORING SITES

Based upon monitoring experience in Oklahoma and other states, we determined that a target of 100 sites distributed across the eastern counties primarily involved in timber harvesting would be adequate to indicate BMP implementation rates and their relation to water quality in the major aspects of silviculture. Although the following was not used to help target the number of sites, the 100 sites actually monitored in Oklahoma represent one site for every 1.26 million cubic feet of timber harvested annually. This can be compared to the previous monitoring project where 77 sites were monitored, which represented one site for every 1.47 million cubic feet of timber harvested annually.

Monitoring sites were also distributed proportionately among three major forestland ownership categories: public, forest industry and non-industrial private forests (NIPF). During the survey, the NIPF category was further divided into a Family Forest category that includes absentee owners (those who did not live on the property) and non-absentee owners, and a Corporate owner category (commercial landowners that do not have wood processing facilities). Sites were generally believed to be representative of the distribution of all silvicultural activities in the region. The target number of sites per county and by ownership category was based upon the estimated annual timber harvest data reported by the U.S. Forest Service in 2002 (Table 1) and timberland ownership data from the 1993 forest inventory (Table 2). Sites to be monitored were chosen randomly from the total monitoring pool by simply counting down the list and selecting every Nth site.

Table 1. Timber Harvest Levels and Distribution of Monitored Sites by County [1]

County	Harvest (thousand cubic feet)	Percent of Total Harvest	Number of Sites Monitored
Adair	630	0.5	4
Atoka	1,525	1.2	3
Bryan	593	0.5	1
Cherokee	323	0.3	2
Choctaw	2,035	1.6	3
Coal	--	--	0
Delaware	635	0.5	1
Haskell	468	0.4	1
Latimer	1,946	1.6	6
LeFlore	13,267	10.6	11
McCurtain	70,437	55.9	40
McIntosh	--	--	0
Mayes	62	0.1	0
Muskogee	--	--	0
Nowata	--	--	0
Ottawa	405	0.3	0
Pittsburg	157	0.1	0
Pushmataha	32,898	26.1	28
Sequoyah	400	0.3	0
Totals	**125,781**	**100.0**	**100**

[1] Source: *Oklahoma's Timber Industry - An Assessment of Timber Product Output and Use, 2002* (USDA Forest Service)

Table 2. Ownership of Eastern Oklahoma Timberland and Distribution of Monitored Sites by Ownership [2]

Ownership Category	% of Timberland Owned	Number of Sites Monitored	% of Sites Monitored
Public	12	9	9
Forest Industry	21	24	24
NIPF	67	67	67

[2] Source: *Forest Resources of East Oklahoma, 1993* (USDA Forest Service)

DATA COLLECTION

On the sites selected for monitoring, Forestry Services contacted the landowner in advance of the evaluation and obtained permission to enter the property. During this initial contact, the forester explained the purpose of the visit and invited the landowner or his/her representative to participate on site during the evaluation. We did not inspect sites where the landowner denied access. In nearly all cases on forest industry property, a company forester accompanied the water quality forester. In most instances the private non-industrial forest landowner or their representative accompanied the forester on their property evaluation. In no case were the evaluation results influenced by others taking part in the review. It was very helpful to have the landowner, their representative or their forester participate in the evaluation because it provided opportunities for additional training and education concerning BMPs.

General information about the landowner and the tract was obtained from several sources, including the landowner, landowner representative, courthouse records, the timber buyer or consultant. Answers to the follow-up questions are generally obtained from the landowner, landowner representative, timber buyer or the consultant.

Site characteristics were obtained by on-the-ground inspection and from maps. The information about the roads, skid trails, stream crossings, streamside management zones, site preparation, landings and wetlands was obtained by an on-the-ground inspection of the site. Every item in each category was evaluated as to whether or not the practice was applicable on the site and, if so, whether it was acceptable and in accordance with BMP recommendations.

An evaluation of significant risks was also included in the site review. According to the Southern Monitoring Protocol, a "significant risk" is a situation or set of conditions that has resulted in or very likely will result in the measurable and significant degradation of water quality, and that can be remedied or otherwise mitigated. A visual determination was made for each BMP or lack of a BMP to see if a significant risk to water quality actually existed. In addition to evaluating individual BMPs, data was also gathered on site characteristics and other factors that could influence the use of BMPs. The checklist includes a comment section for use in describing deficiencies found during the site inspection and recommendations for compliance with recommended best management practices.

After the inspection, we provided a copy of the completed checklist and comments with applicable recommendations to the landowner, logging contractor, timber buyer and assisting forester as appropriate. We also emphasized during all contacts that the project as a whole and the checklist itself were intended to be an educational tool, rather than a punitive measure, to improve BMP understanding and performance by all parties.

SUMMARY AND DATA ANALYSIS

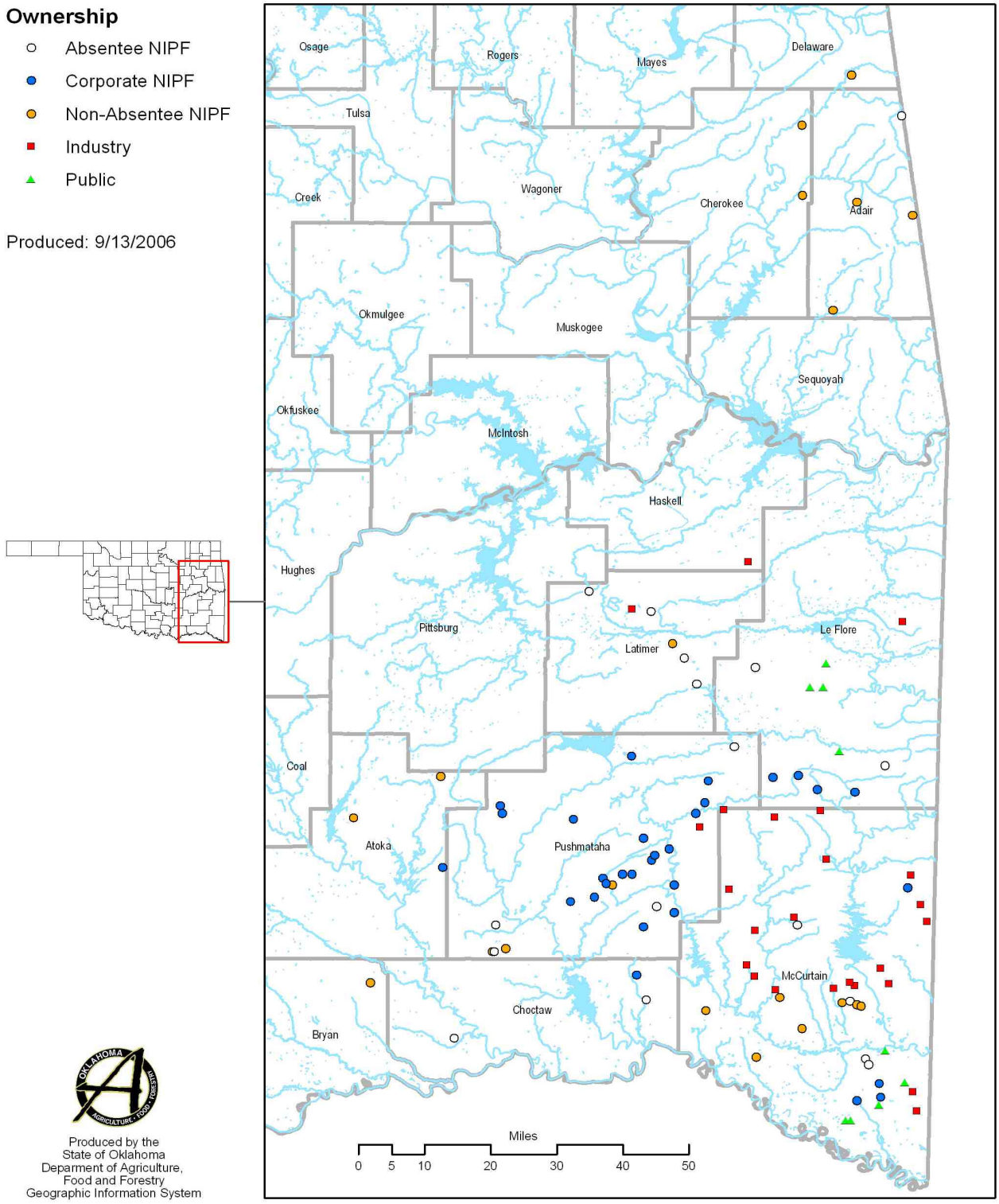
The end result of using the checklist on an individual site is a count of "Yes," "No," and "Not Applicable/Not Needed" answers for each category of the evaluation. Dividing the number of "Yes" answers by the total of the "Yes" and "No" answers gives a percentage "score" which reflects the extent of implementation for the BMP category or for the tract as a whole. Compiling evaluations allows analysis of implementation by BMP practice, BMP category and for all sites, as well as by ownership or other subcategories.

RESULTS

The 100 sites were evaluated between August 2004 and May 2006. These 100 sites represented 13,493 total treated acres throughout eastern Oklahoma, resulting in an average tract size of 135 acres. Locations of these sites are shown geographically by ownership category in Figure 1.

The raw data for each category on the checklist is included in the Appendix. A summary and analysis of the monitoring results for each of the major BMP categories follows, along with a discussion of improvement opportunities, project conclusions and next steps.

Figure 1. Approximate Locations of Monitored Sites by Owner Category



SITE CHARACTERISTICS

Ownership. The 100 monitoring sites were distributed both geographically and by ownership, as shown on the map in Figure 1. NIPF landowners owned 67 of the sites. Forest Industry owned 24 sites. Nine sites were on publicly owned lands (National Forest). The 67 NIPF sites included 17 absentee ownership, 20 non-absentee ownership and 30 corporate ownership sites.

Type of Treatment. The silvicultural activity on the 100 monitored sites is grouped as follows: 45 clearcut harvests, 38 partial harvests, 14 first thinnings of pine plantations and 3 site preparation only sites. The partial harvests included diameter limit, seedtree, shelterwood and selection harvests. There were 29 sites evaluated with site preparation being a portion of the total site evaluation.

Forester Involvement. Professional foresters were involved in planning and/or implementing the silvicultural operation on 77 of the sites. On 29 sites, the forester was employed by forest industry. On 21 sites, the forester was employed by corporate landowners. Private consultants were involved on 15 of the sites. National Forest foresters were involved on nine sites and a Forestry Services forester was involved with three "site preparation only" sites.

Physical Characteristics. Terrain classification, soil type and soil erodibility were recorded from the Natural Resources Conservation Service (NRCS) soil survey, where applicable, or were estimated by the forester in the field. A summary of these site characteristics is as follows:

> *Terrain:* Twelve sites were on flat terrain, 67 sites were on hilly terrain and 21 sites were on steep terrain.
> *Soil Type:* Two sites were dominated by clay soils, 66 sites were clay loam, 7 sites were loam, 25 sites were sandy loam and no sites were sand.
> *Erodibility:* Forty sites were on soils with low erodibility, 58 sites were on medium erodibility soils and 2 sites were on high erodibility soils.

Presence of Water. Of the 100 sites, 74 had either a perennial (11) or intermittent (47) stream or both perennial and intermittent (16). A permanent water body was found within 1,600 feet of 48 sites.

ROADS

Roads have historically been identified as the largest source of NPS pollution associated with forestry activities. Road construction and maintenance activities generally expose mineral soil, and exposed soil offers opportunities for soil movement unless best management practices are incorporated to control water drainage.

Proper road use during silvicultural operations is an important factor in minimizing road impacts on water quality. This situation is further complicated by the use of these roads for recreational and other purposes. Recreational users may not respect water control structures and often find them a challenge to be overcome instead of an impediment to further use.

Roads related to silvicultural activities are of two types: (1) permanent roads and (2) skid trails or temporary (secondary) roads. Each type was evaluated separately.

PERMANENT ROADS

Permanent roads were evaluated for implementation of BMPs when they were used in the forestry operation. Permanent roads in the forestry context are generally graded dirt or gravel roads that are used for year-round access. County roads were not included in the monitoring because they are maintained as public roads.

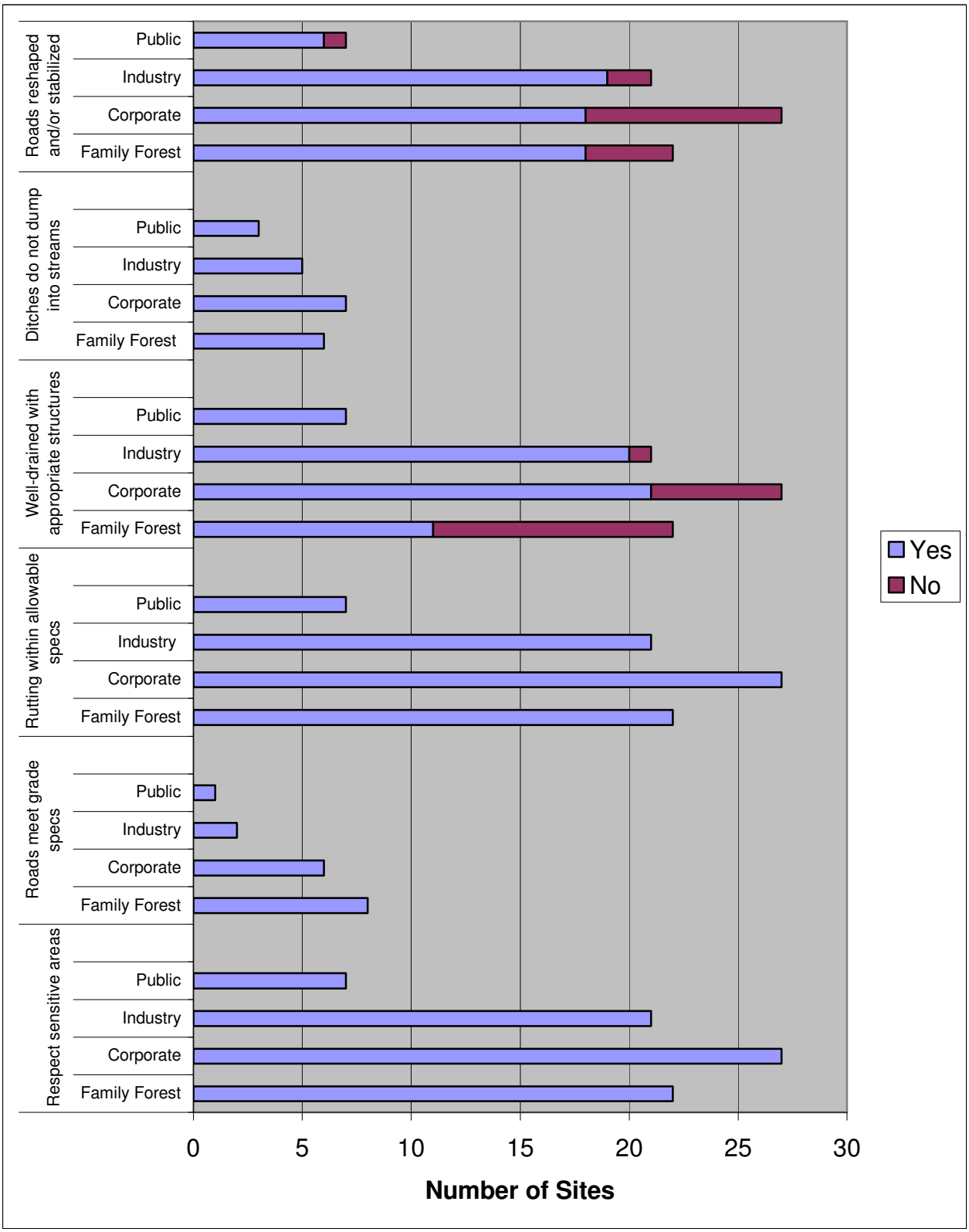
Permanent road evaluation was applicable on 77 of the 100 sites. Overall implementation for permanent roads was 90% with no significant risks identified. The areas with the highest level of implementation (100%) in this category were with respect to sensitive areas, new or reworked roads meeting grade specifications, rutting within allowable specifications and ditches not dumping into streams. The lowest implementation rates were for roads not being well-drained with appropriate structures (77%) and roads not being reshaped and/or stabilized (79%). In nearly every case, landowners made plans to repair their roads as a result of this evaluation and contact.

Actual implementation data is shown in Table 3. Figure 2 illustrates the rate of BMP implementation in each category of permanent roads by type of ownership. This format provides a readily visible view of the practices and ownership categories where BMP implementation needs improvement.

Table 3. Implementation of Specific BMPs Related to Permanent Roads

Best Management Practice	Yes	% Implementation	No	NA/ NN	Number of Significant Risks	Margin of Error
Respect sensitive areas	77	100	0	23	0	0%
Roads meet grade specs	17	100	0	83	0	0%
Rutting within allowable specs.	77	100	0	23	0	0%
Well-drained with appropriate structures	59	77	18	23	0	9.6%
Ditches do not dump into streams	21	100	0	79	0	0%
Roads reshaped and/or stabilized	61	79	16	23	0	9.3%
Permanent Roads Overall		**90**				

Figure 2. BMP Implementation on Permanent Roads by Ownership Category



SKID TRAILS AND TEMPORARY ROADS

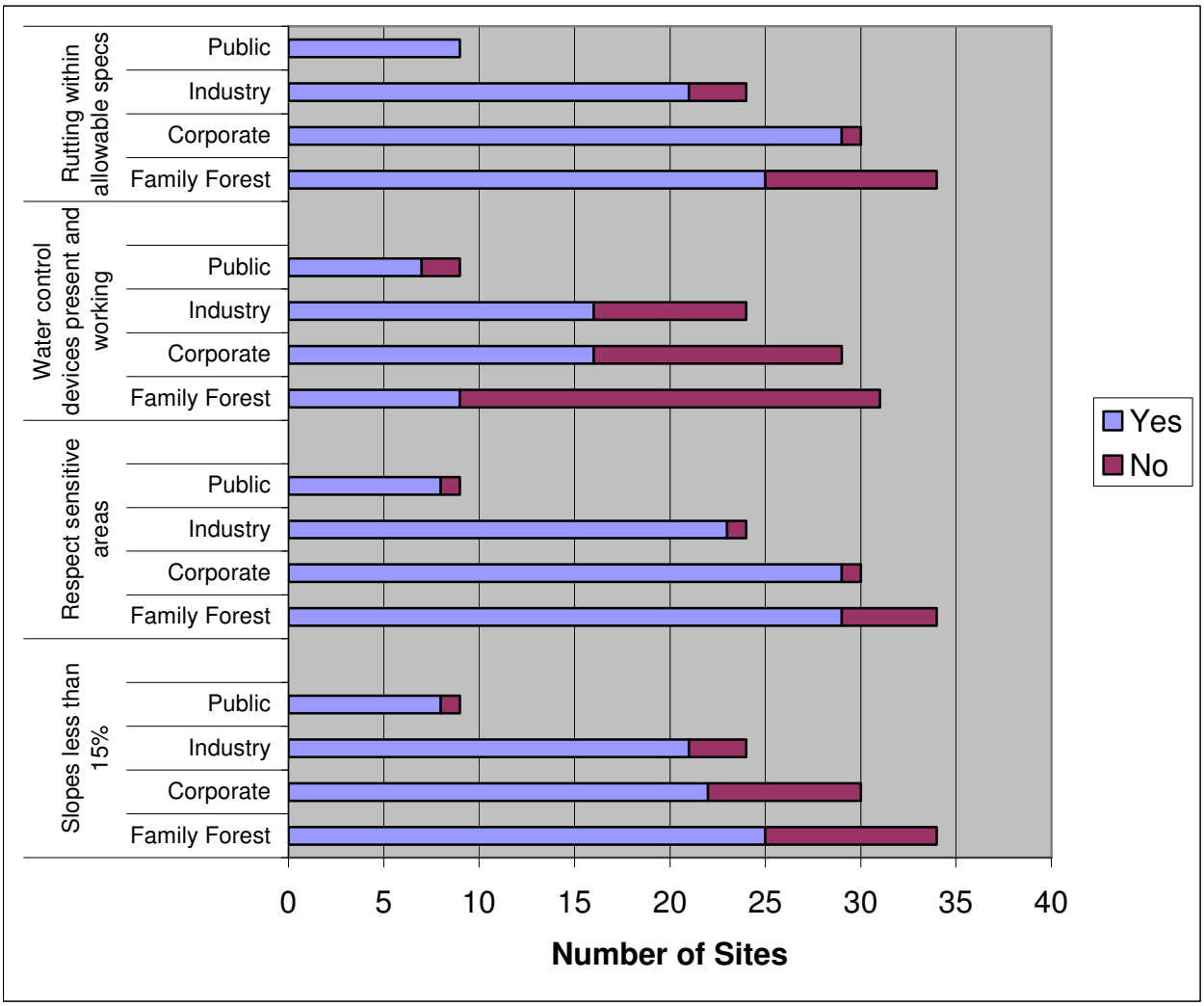
Skid trails and temporary roads were evaluated on 97 of the 100 sites. Skid trails are routes through the logging area by which logs are skidded or dragged to a permanent road or central loading point. Temporary roads are not designed to carry traffic long-term and are usually closed or reforested after the harvest activity. Implementation for skid trails and temporary roads overall was 77% and one significant risk was noted. The lowest implementation rate (52%) was for not having water control devices present and working and resulted in the significant risk. The area with the highest implementation rate (92%) was location of skid trails and temporary roads with respect to sensitive areas. Data is presented in Table 4 and Figure 3.

It is important to note that remediation of the significant risk has been accomplished, and, in other areas where water control devices are needed, the landowners have made restoration plans.

Table 4. Implementation of Specific BMPs Related to Skid Trails and Temporary Roads

Best Management Practice	**Yes**	**% Implementation**	**No**	**NA/ NN**	**Number of Significant Risks**	**Margin of Error**
Slopes less than 15%	76	78	21	3	0	8.4%
Respect sensitive areas	89	92	8	3	0	5.5%
Water control devices present and working	48	52	45	7	1	10.4%
Rutting within allowable specs.	84	87	13	3	0	6.8%
Temporary Roads Overall		**77**				

Figure 3. BMP Implementation on Skid Trails and Temporary Roads by Ownership Category



STREAM CROSSINGS

Stream crossings were evaluated on 25 sites, and the data is presented in Table 5 and Figure 4. Eight sites had crossings on permanent roads only and 14 sites had crossings on temporary roads only. Three sites had crossings on both permanent and temporary roads. On permanent roads, the overall implementation rate for stream crossings was 91% with no significant risks noted. All categories rated an implementation rate of 100%. This seems to indicate recognition by landowners and contractors the importance of protecting water quality and maintaining the permanent road system.

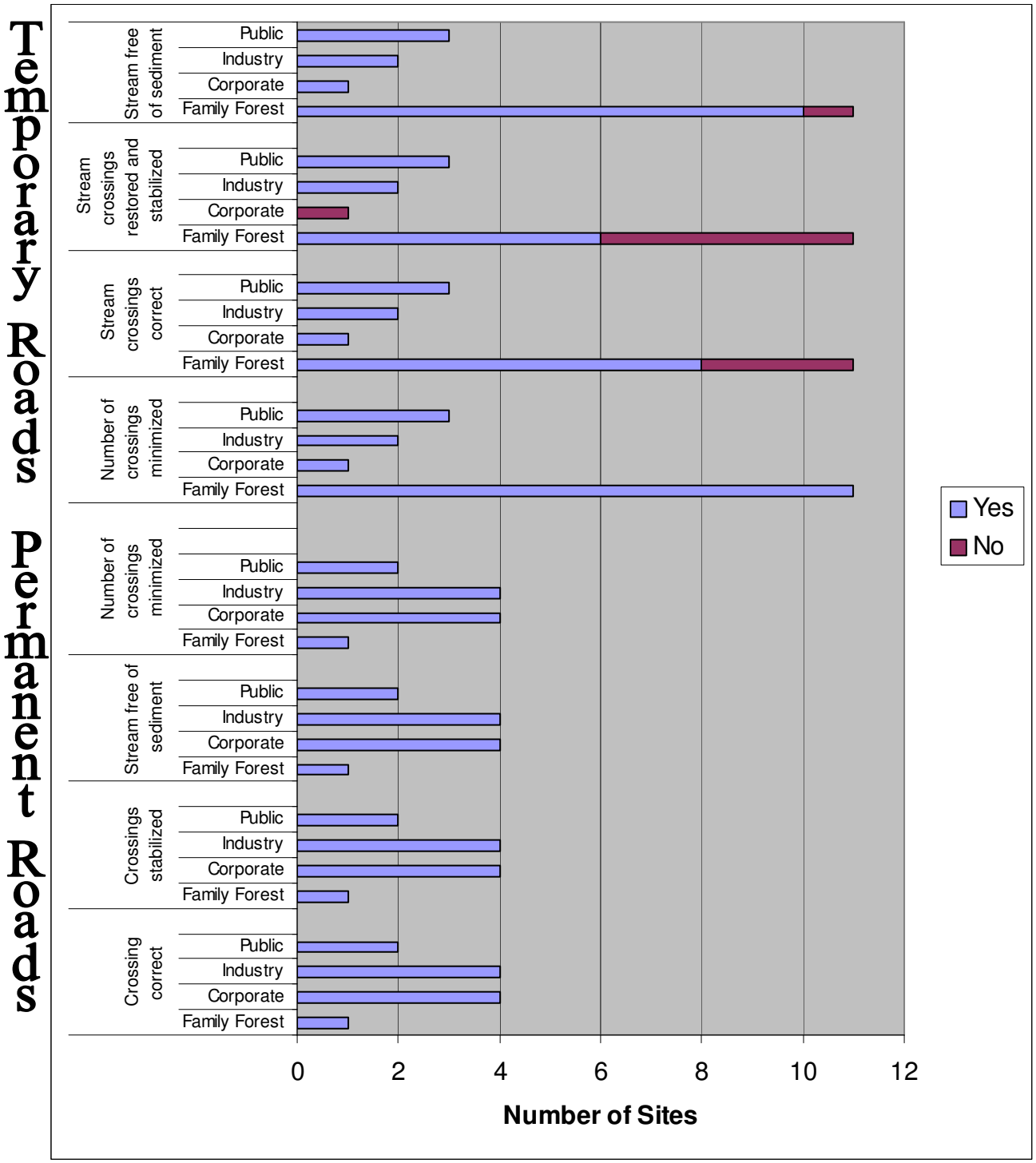
On temporary roads, the highest implementation rate was the number of crossings being minimized (100%). The lowest rating for temporary roads was the crossings not being restored and stabilized (65%), with two significant risks identified. Even though the number of sites with temporary stream crossings was few, these practices still need follow-up attention. Remediation

of the two significant risks has been accomplished. In all cases, landowners received our recommendations for restoration very favorably.

Table 5. Implementation of Specific BMPs Related to Stream Crossings

Best Management Practice	Yes	% Implementation	No	NA/ NN	Number of Significant Risks	Margin of Error
On Temporary Roads						
Number of crossings minimized	17	100	0	83	0	0%
Stream crossings correct	14	82	3	83	0	18.6%
Crossings restored and stabilized	11	65	6	83	2	23.1%
Stream free of sediment	16	94	1	83	0	11.5%
On Permanent Roads						
Crossing correct	11	100	0	89	0	0%
Stabilized	11	100	0	89	0	0%
Stream free of sediment	11	100	0	89	0	0%
Number of crossings minimized	11	100	0	89	0	0%
Stream Crossings Overall		**91**				

Figure 4. Road BMP Implementation on Stream Crossings by Ownership Category



STREAMSIDE MANAGEMENT ZONES

Streamside Management Zones (SMZs) are recommended on all perennial and intermittent streams, lakes, ponds and reservoirs. All sites with either perennial or intermittent streams were evaluated for the presence and adequacy of SMZs. Streams were present on 74 of the 100 sites. Eleven of the 74 sites contained perennial streams only, 47 had intermittent streams only and 16 sites contained both perennial and intermittent streams. SMZ data is presented in Table 6 and Figure 5.

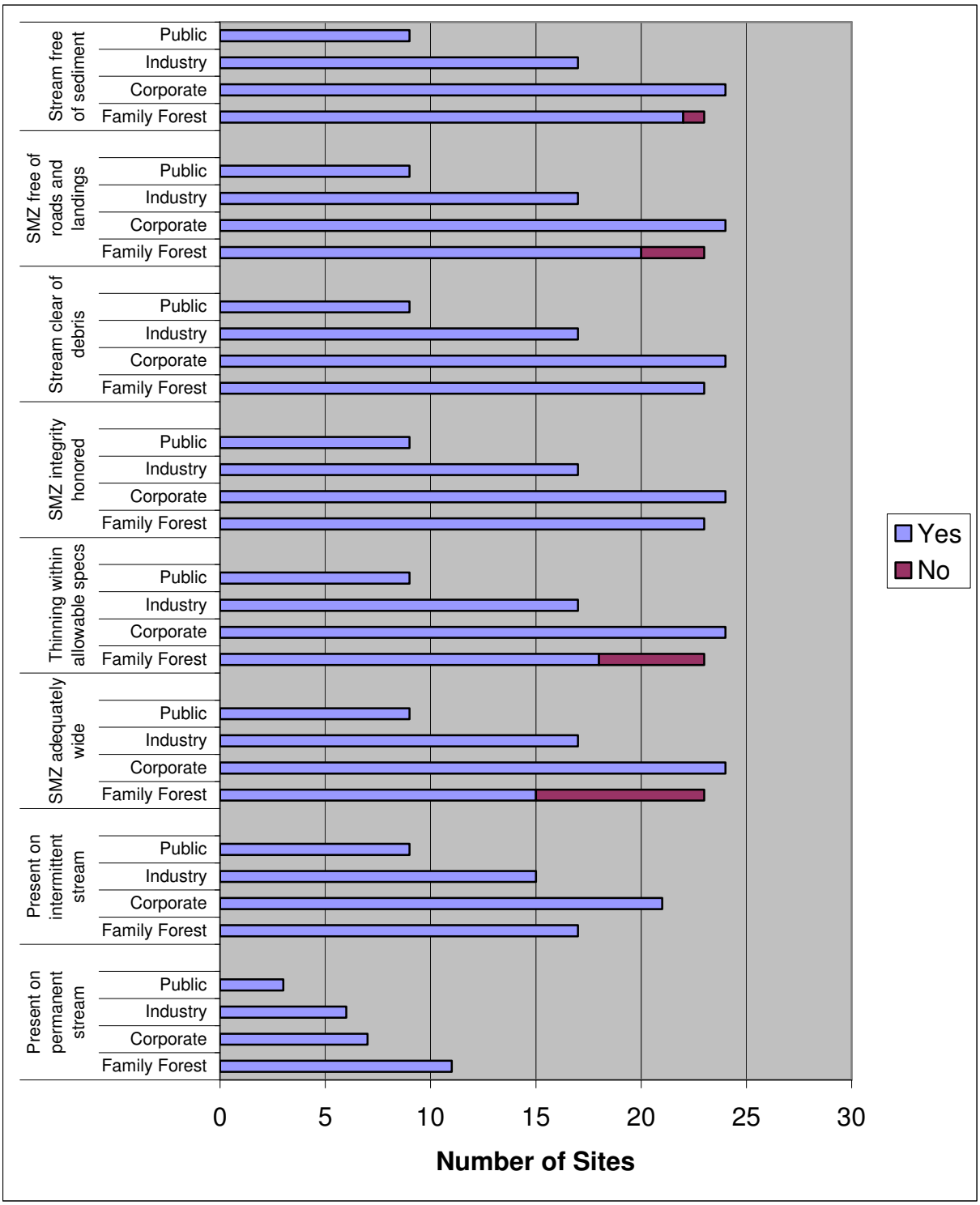
The highest implementation rate (100%) was on four practices: the streams being clear of debris, integrity of the SMZ honored and SMZ presence on all perennial and intermittent streams. The lowest implementation rate (89%) was the SMZ not being adequately wide.

Overall implementation of SMZ BMPs was 97% with no significant risks. It is noteworthy that this category has a high BMP implementation rate with no significant risks, an indication that landowners and contractors generally respect the importance of streamside management zones and their role in water quality protection.

Table 6. Implementation of Specific BMPs Related to Streamside Management Zones

Best Management Practice	Yes	% Implementation	No	NA/ NN	Number of Significant Risks	Margin of Error
Present on permanent stream	27	100	0	73	0	0%
Present on intermittent stream	62	100	0	38	0	0%
SMZ adequately wide	65	89	8	27	0	7.3%
Thinning within allowable specs.	68	93	5	27	0	6.0%
SMZ integrity honored	73	100	0	27	0	0%
Stream clear of debris	73	100	0	27	0	0%
SMZ free of roads and landings	70	96	3	27	0	4.6%
Stream free of sediment	72	99	1	27	0	2.3%
SMZs Overall		**97**				

Figure 5. BMP Implementation on Streamside Management Zones by Ownership Category



SITE PREPARATION

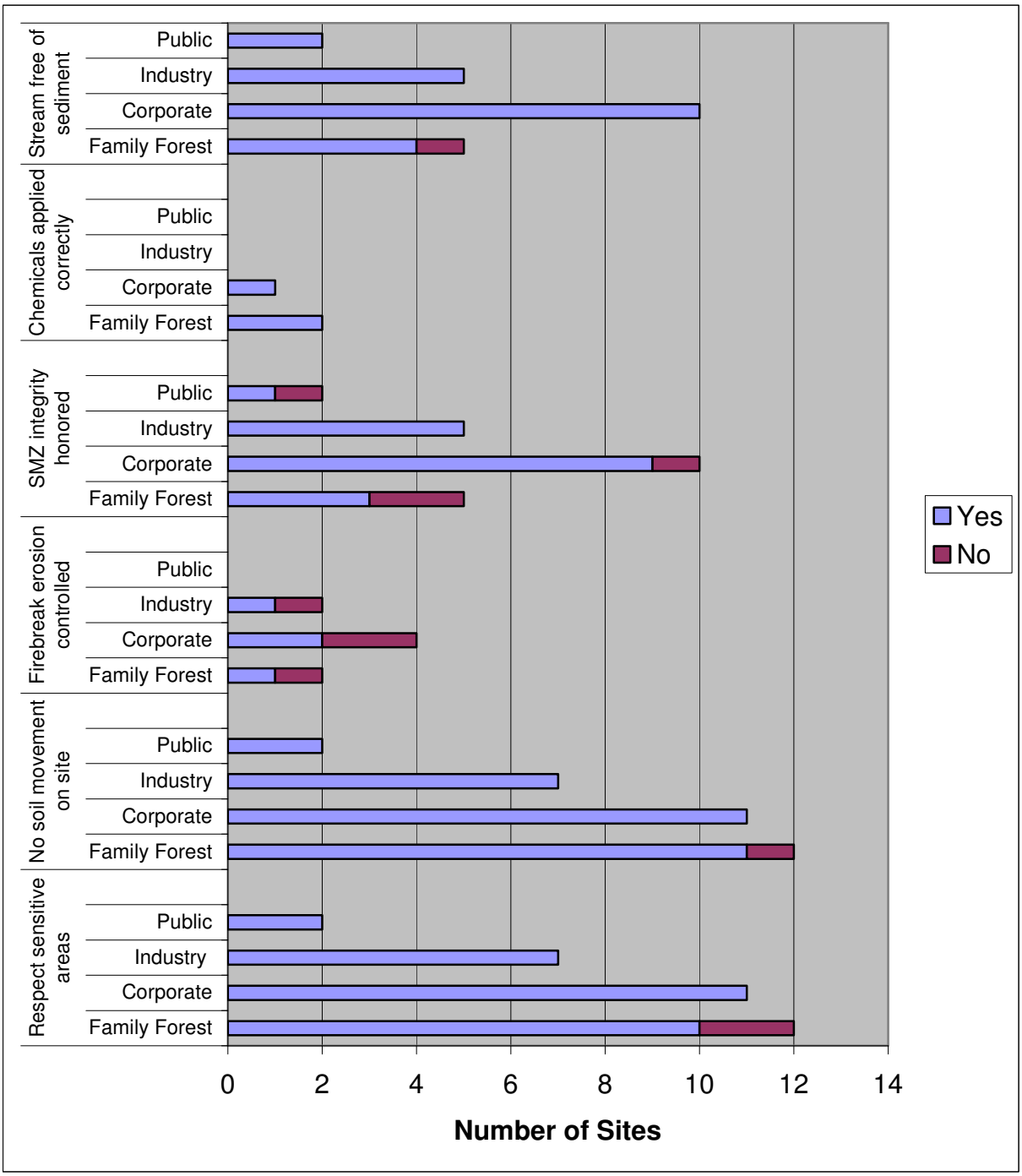
Site preparation consists of work done to prepare a site for the growing of trees, generally to plant seedlings. Thirty-two sites were evaluated for implementation of site preparation BMPs. A variety of site preparation techniques were evaluated, including ripping, burning, drum chopping, shearing, piling, injecting and spraying, sometimes used in combination. The data is presented in Table 7 and Figure 6. The overall implementation rate for site preparation was 90%.

The lowest implementation rate (50%) was for not having erosion properly controlled on the firebreak with one significant risk being identified. The highest implementation rate (100%) was for chemicals being applied correctly. The implementation rate for respecting sensitive areas was 94% with one significant risk. Remediation of the significant risks has already been accomplished.

Table 7. Implementation of Specific BMPs Related to Site Preparation

Best Management Practice	Yes	% Implementation	No	NA/ NN	Number of Significant Risks	Margin of Error
Respect sensitive areas	30	94	2	68	1	8.4%
No soil movement on site	31	97	1	68	0	6.0%
Firebreak erosion controlled	4	50	4	92	1	35.4%
SMZ integrity honored	18	82	4	78	0	16.4%
Chemicals applied correctly	3	100	0	97	0	0%
Stream free of sediment	21	95	1	78	0	9.3%
Site Preparation Overall		**90**				

Figure 6. BMP Implementation Related to Site Preparation by Ownership Category



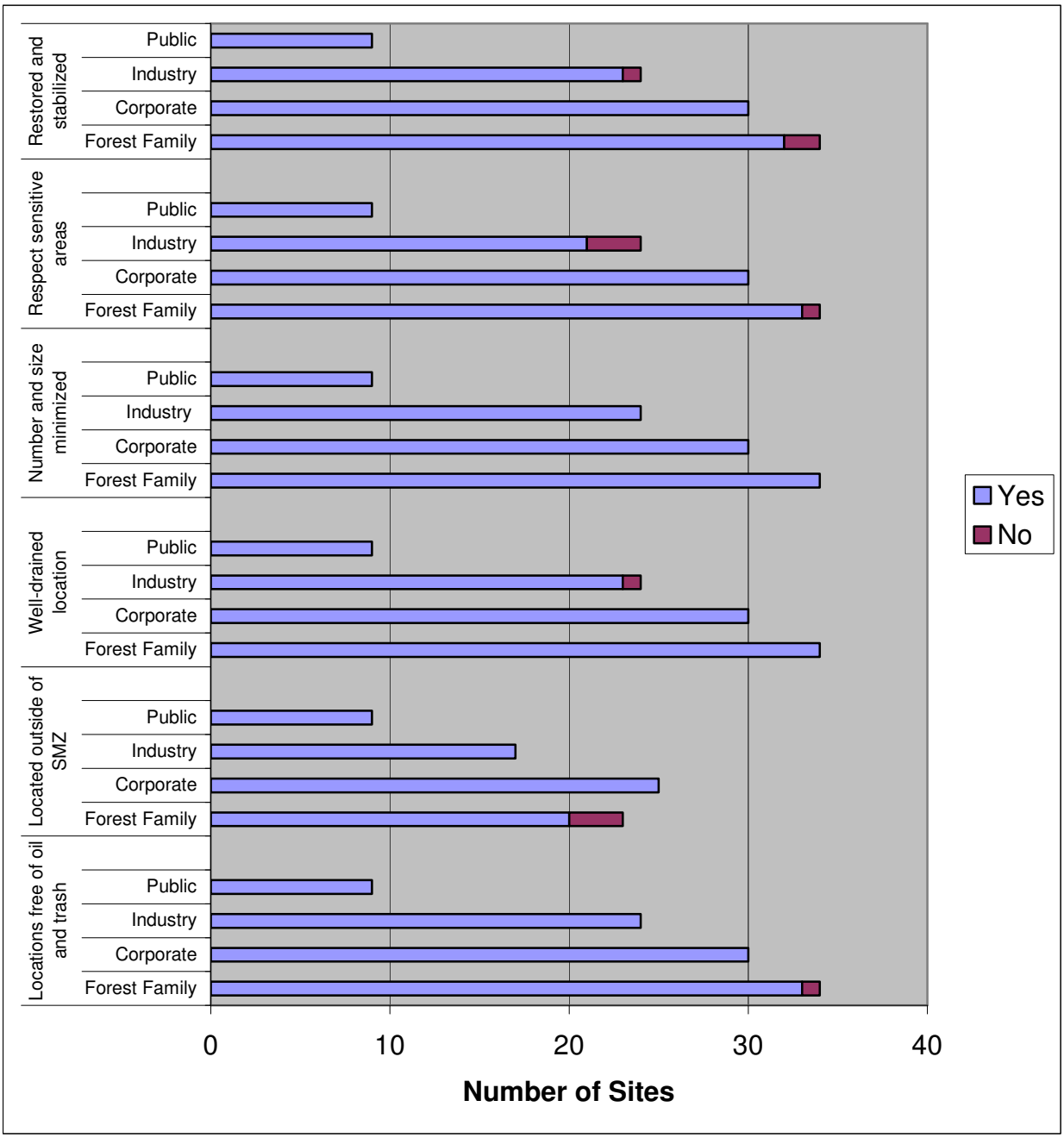
LANDINGS

Landings, also referred to as "sets," are areas where logs are gathered, delimbed, bucked (cutting-to-length for certain products and/or removing the top) and loaded onto trucks. Landings were evaluated on 97 sites with an overall implementation rate of 98% and no significant risks were noted. The highest implementation rate (100%) was for the number and size of landings being minimized. The lowest implementation rate (96%) was for landings not being located outside the SMZ and also placing landings in sensitive areas. Owners of landings where problems were identified have already planned remediation activities. Data is presented in Table 8 and Figure 7.

Table 8. Implementation of Specific BMPs Related to Landings

Best Management Practice	Yes	% Implementation	No	NA/ NN	Number of Significant Risks	Margin of Error
Locations free of oil and trash	96	99	1	3	0	2.0%
Located outside of SMZ	71	96	3	26	0	4.6%
Well-drained location	96	99	1	3	0	2.0%
Number and size minimized	97	100	0	3	0	0%
Respect sensitive areas	93	96	4	3	0	4.0%
Restored / stabilized	94	97	3	3	0	3.5%
Landings Overall		**98**				

Figure 7. BMP Implementation Related to Landings by Ownership Category



WETLANDS

Only one of the 100 sites contained wetlands or a "wetland like" area, but not necessarily jurisdictional wetlands. Although this site had an overall implementation of 100%, the data is insufficient to draw any broad conclusions on wetlands overall. No significant risks were noted. Wetlands data is presented in Table 9.

Table 9. Implementation of Specific BMPs Related to Wetlands

Best Management Practice	Yes	% Implementation	No	NA/ NN	Number of Significant Risks	Margin of Error
Avoid altering hydrology of site	1	100	0	99	0	0%
Road drainage structures installed properly	0	NA	0	100	0	0%
Mandatory road BMPs followed	0	NA	0	100	0	0%
Wetlands Overall		**100**				

IMPLEMENTATION BY SITE CHARACTERISTICS

Ownership. BMP implementation varied by type of ownership. The public ownership category (National Forest) had the highest implementation rate of 96.8% for nine sites, with no significant risks identified. The 24 sites monitored on forest industry land had an overall BMP implementation rate of 95.4% with no significant risks. NIPF landowners had an overall BMP implementation rate of 89.4% on the 67 sites inspected and five significant risks were noted.

Type of Activity. Four types of silvicultural activities were monitored: clearcut, partial harvest, first thinning of pine plantations and site preparation only. Three sites were evaluated for site preparation only although site preparation was evaluated along with other activities on 29 sites. As shown in Table 10, BMP implementation rates varied somewhat by type of treatment.

Table 10. Overall BMP Implementation by Type of Operation

Type of Operation	No. of Sites	BMP Implementation
Clearcut	45	91.0%
Partial harvest	38	90.6%
First thinning	14	95.9%
Site preparation only	3	85.7%

Region. Eastern Oklahoma was divided into the northern region and the southern region for comparison of BMP implementation rates, with the Arkansas River as the boundary. There is considerably more forestry activity in the southern region than in the northern region. Ninety-three sites were monitored in the southern region with an overall implementation rate of 92.1%. Seven sites were monitored in the northern region with an implementation rate of 82.3%. The higher implementation in southeastern Oklahoma is to be expected due to the concentration of National Forest and industrial ownership and the presence of a much better trained and more sophisticated timber industry.

Terrain. Monitoring sites were classified as flat, hilly or steep. BMP implementation on the 12 flat sites was 93.6% with one significant risk. On the 67 hilly sites, it was 92.4% with three significant risks, and, on the 21 steep sites, it was 88.6% with one significant risk.

Erodibility Hazard. Monitoring sites were identified as low, medium or high for soil erodibility. BMP implementation was 92.9% on a total of 40 low erodibility sites with no significant risks noted. On 58 medium erodibility sites, it was 90.9% with five significant risks. On the two high erodibility sites, it was 86.8% with no significant risks.

Distance to Permanent Water. Distance to the nearest permanent water was determined for each site. BMP implementation on the 27 sites with permanent water less than 300 feet from the site was 91.3% with three significant risks identified. On the 6 sites with permanent water 300 to 800 feet from the site, it was 93.7% with no significant risks. On the 15 sites with permanent water 800 to 1,600 feet from the site, it was 92.5% with no significant risks, and, on the 52 sites with permanent water over 1,600 feet from the site, it was 91.3% with two significant risks.

STATISTICAL SIGNIFICANCE

To help determine the impact of various parameters on BMP implementation rates, statistical analyses were performed on the following categories:

- Forester Involvement
- Activity Supervised by Landowner
- Landowner Familiarity with BMPs
- Contractor Familiarity with BMPs
- Logger Attended BMP Workshop
- BMPs in the Timber Sale Contract
- Landowner Membership in Forestry Organizations

For some of the parameters listed above, a definite “Yes” or “No” answer could not be readily determined. For the purpose of these calculations, “Unknown” answers were included in the “No” answers.

Results of the statistical analyses are presented in Table 11 and are described on the following pages. The implementation ratings for the “Yes” answers and the “No” answers were calculated to be significantly different in each of these categories.

Table 11. Results of Tests To Determine Statistically Significant Differences

Category	BMP Implementation When the Answer Is… …Yes	…No
Was a forester involved in the activity?	93.8%	81.7%
Was the activity supervised by the landowner?	92.2%	83.0%
Was the landowner familiar with BMPs?	92.1%	83.7%
Was the contractor familiar with BMPs?	92.1%	84.3%
Had the logger attended a BMP workshop?	92.3%	84.4%
Were BMPs included in the timber sale contract?	92.9%	79.4%
Is landowner a member of a forestry organization?	93.2%	85.9%

FORESTER INVOLVEMENT

BMP implementation was higher when a professional forester was involved in the timber sale or silvicultural activity. Seventy-seven sites were identified as having a professional forester involved, with an implementation rate of 93.8%. Sites in which there was no forester involvement had an implementation rate of 81.7%.

ACTIVITY SUPERVISED BY LANDOWNER

On the 87 sites where the landowner or their representative supervised the activity, the BMP implementation rate was 92.2%. The 13 sites where there was no supervision by the landowner or their representative the implementation rate was 83.0%.

LANDOWNER FAMILIARITY WITH BMPS

Landowner familiarity with BMPs influences implementation. Sites with landowners who were not familiar with BMPs had an overall implementation rate of 83.7%, while sites with landowners who were familiar with BMPs had an implementation rate of 92.1%. Eighty-seven sites had landowners who were familiar with BMPs while 13 sites had landowners who were not familiar with BMPs.

CONTRACTOR FAMILIARITY WITH BMPS

When the harvesting was done by loggers who were familiar with BMPs, which was on 87 sites, the implementation rate was 92.1%. When the harvesting was done by loggers who where unfamiliar with BMPs, which was on 10 sites, the implementation rate was 84.3%. Ninety-seven sites were monitored for harvesting BMPs.

LOGGER ATTENDED BMP WORKSHOP

This category is closely related to the previous category. Of the 97 sites that were monitored for harvesting BMPs, 84 sites had loggers who attended a BMP workshop, and the implementation

rate was 92.3%. Of the 13 sites that had loggers who had not attended a BMP workshop, the implementation rate was 84.4%.

BMPS IN TIMBER SALE CONTRACT

BMPs were included in 86 of the contracts on the sites monitored, resulting in a BMP implementation rate of 92.9%. Of the 14 sites that had no BMPs in the contract, the implementation rate was 79.4%.

LANDOWNER MEMBERSHIP IN FORESTRY ORGANIZATIONS

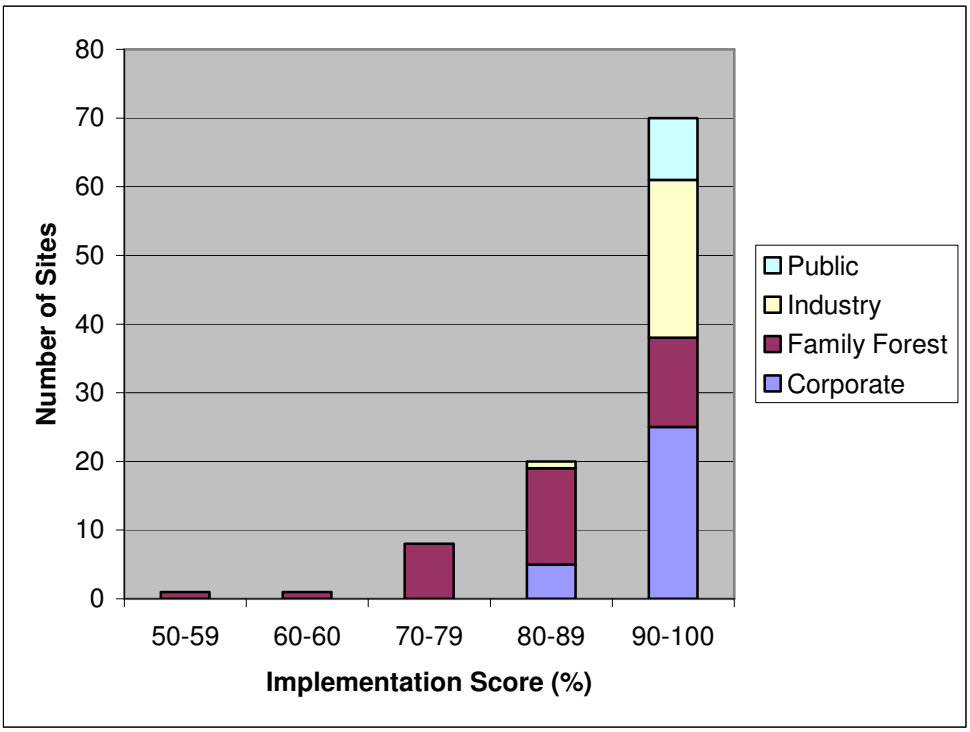
Membership in forestry-related organizations (e.g., Oklahoma Forestry Association, county landowner associations, Oklahoma Woodland Owners Association, trade associations, etc.) can have an impact on implementation. Landowners who are members of these organizations are generally more involved in the forestry practices that are conducted on their property. Landowners were identified as being members of forestry organizations on 57 sites with an implementation rate of 93.2%, while implementation for non-members on 34 sites was 85.9%.

OVERALL BMP IMPLEMENTATION

BMP implementation on U.S. Forest Service land is currently 96.8% with no significant risks to water quality identified. Implementation on forest industry land is currently 95.4% with no significant risks. Implementation on NIPF land is currently 89.4% with five significant risks identified. On sites where the NIPF landowners were absentees, the implementation rate was 86.0%. ***For the project as a whole, the BMP implementation rate was 91.6% with a total of 5 significant risks identified over all ownership categories.***

To illustrate the spread of the implementation scores, Figure 8 separates the results into five categories: 50-59%, 60-69%, 70-79%, 80-89% and 90-100%. This provides the number of tracts across all ownership types receiving the respective level of overall BMP implementation.

Figure 8. Overall BMP Implementation Score by Number of Sites and Type of Ownership



The results of Oklahoma's 2004-2006 monitoring project can be compared, at least in general terms, to recent monitoring done by the Texas Forest Service in 2003-2005 and the Arkansas Forestry Commission in 2003-2004, as shown in Table 12. These are relative measures only, as the monitoring each state conducts is a measure of BMP compliance against that state's BMP guidelines. Table 12 also includes data from the 2003-2004 Oklahoma monitoring for comparison with the 2004-2006 data.

Table 12. BMP Implementation in Oklahoma, Texas and Arkansas by Ownership Category

	BMP Implementation In			
Ownership Category	**Oklahoma 2003-2004**	**Oklahoma 2004-2006**	**Texas 2003-2005**	**Arkansas 2003-2004**
Public (National Forest)	98.1%	96.8%	98.3%	98%
Forest Industry	93.2%	95.4%	95.7%	93%
NIPF-Family Forest	86.9%	85.3%	88.7%	80%
NIPF Corporate	NA	93.6%	96.0%	NA
All Ownerships	90.5%	91.6%	91.7%	88%

IMPROVEMENT OPPORTUNITIES

Ownership: Generally, BMP implementation on NIPF lands lags behind other ownerships, and accounts for all five of the significant risks. NIPF landowners are generally less actively involved in forest management, sell timber infrequently, may be absentee and may lack technical knowledge necessary to implement BMPs. In addition, these owners use formal timber sale contracts less often than other owners, and miss this opportunity to require water quality BMPs during forestry activities. In our first BMP Compliance Monitoring Project, which was completed early in 2004, 58% of the tracts evaluated were NIPF landownership. In this project, 67% of the tracts evaluated were NIPF landownership. Also, we have held additional landowner workshops, and made greater use of existing newsletters and newspaper articles. We are also refining a timber sale informational packet that emphasizes use of BMPs in the sample timber sale contract. To reach additional landowners, we are participating in the landowner outreach efforts being conducted by NRCS and Langston University's outreach coordinator in southeastern Oklahoma. Even so, future BMP educational efforts need to focus greater attention on NIPF landowners.

Location: As discussed previously, BMP implementation was lower in northeast Oklahoma than in the southeast. Forestry Services has placed greater emphasis on logger and landowner educational programs in northeastern Oklahoma. An agreement has been developed with the Oklahoma Conservation Commission and Scenic Rivers Commission for logger and landowner workshops and logger tailgate sessions in the Illinois River, Wister Lake and Spavinaw Creek watersheds. Much of this work has been done and more of these workshops and tailgate sessions are planned for the near future. Additional sites have been monitored in northeastern Oklahoma. During the first project, four sites were monitored. During this project, seven sites (7% of the total) were monitored even though only 2.0% of the annual harvest in Oklahoma comes from the northeastern counties. Also, three additional sites in the western portion of central and southeastern Oklahoma were monitored.

Practices: Data from the monitoring report has been incorporated into logger BMP workshops. Specific BMPs with lower implementation rates, such as water control devices on temporary roads and skid trails, stream crossing restoration and stabilization and firebreak erosion control measures, now receive greater emphasis in these workshops to make loggers and landowners more aware of potential trouble spots.

CONCLUSIONS

Owners of forestland and members of the logging community that operate on those lands are generally doing a good job of BMP implementation. The project shows that BMP implementation was positively influenced by landowner familiarity with BMPs, professional forester involvement, logger training in BMPs and landowner membership in forestry-related organizations.

Forest industry has played a significant role in increasing BMP implementation. This has occurred primarily through its support of Oklahoma's water quality program and its participation

in the American Forest and Paper Association's Sustainable Forestry Initiative program. Water quality has been demonstrated a top priority by most companies, as evident from their requirement that all contractors attend formal BMP training.

State efforts are also having a positive impact, including logger training held in cooperation with the Arkansas Timber Producers Association, development of publications, preparation of comprehensive management plans through the Forest Stewardship Program and developing a positive relationship with all elements of Oklahoma's forestry community.

This project has brought to light the challenges of coordinating with all of the various entities involved in forest water quality management in Oklahoma. Ownership size, property boundaries and landowner objectives contribute significantly to these complexities. Coordination and cooperation between landowners is an essential element in water quality protection.

Although BMP implementation is generally high, there is room for improvement. The project did help identify BMP practices that need more focused attention, and did recognize five significant risks to water quality. Continuing effective educational and technical assistance programs for landowners, foresters and the logging community will improve BMP performance and will minimize the potential water quality impacts from silvicultural operations.

NEXT STEPS

This project has provided valuable information for comparison with the 2003-2004 monitoring project. Improvements have been made. Also, there is a continuing need for improvement in some areas. It also continues to provide insights into the effectiveness of the State's BMP guidelines. Improved cooperation has developed between ODAFF Forestry Services, forest industry, the logging community, the Oklahoma Forestry Association, private landowners, government agencies, Oklahoma State University and others in water quality.

Observations are being used in the revision of Oklahoma's Forestry BMP Guidelines. This revision is being undertaken in cooperation with the BMP committee. Oklahoma's original forestry BMPs were developed by a Blue Ribbon Forestry Panel in 1976, and have undergone only minor revisions since that time. The compliance-monitoring project, the demonstration road near Daisy, Oklahoma, logger education and tailgate sessions, previous monitoring efforts, discussions with other foresters and loggers on the ground, BMP revisions in other states and research have all helped identify areas for improvement and refinement.

The project also pointed out areas where problems are most likely to occur. Results will be used in ongoing educational and technical assistance efforts with loggers and landowners to target practices, locations and cooperators most in need of attention. This project also helped us identify ways to improve the BMP Monitoring Checklist.

Forestry Services recognizes the value of water quality monitoring efforts and plans to conduct formal compliance monitoring approximately every two years.

APPENDIX

- *Oklahoma BMP Monitoring Checklist*
  This section includes the checklist used for the data collection phase of the project.

- *Evaluation Criteria for BMP Monitoring Checklist*
  This document includes additional definitions and explanatory notes to help clarify items on the Monitoring Checklist.

- *Summary of BMP Compliance Monitoring Checklist Data on All Sites*
  This is a compilation of the raw monitoring data from which we drew our conclusions.

OKLAHOMA BMP MONITORING CHECKLIST

I. General Landowner and Tract Information Site ID ☐

County ☐ Township ☐ Range ☐

Latitude: Deg ☐ Min ☐ Longitude: Deg ☐ Min ☐

Owner Type: ☐N ☐A ☐C ☐I ☐P

Forester Type ☐ Name ☐

Landowner Vitals:

Timber Buyer ☐ Logging Contractor ☐ Name ☐

Activity ☐ Acres Affected ☐ Address ☐

Est. Year ☐ Quarter ☐ Date of Inspection ☐ City/State/Zip ☐

Inspector ☐ Accompanied by ☐ Owner Phone ☐

II. Site Characteristics

Terrain : ☐ Flat ☐ Hilly ☐ Steep

Rock Outcroppings Present? ☐ Yes

Erodibility Hazard: ☐Low ☐Medium ☐High

Type of Stream Present:
☐ Perennial ☐ Intermittent

Distance to nearest permanent water body (ft.):
☐ < 300 ☐ 300-800
☐ 800-1,600 ☐ > 1,600

Name and texture of predominant soil association: ☐
☐ Clay ☐ Loam ☐ Sand
☐ Clay Loam ☐ Sandy Loam

III. Permanent Roads

	YES	NO	NA/NN	Sig. Risk
1. Respect Sensitive Areas	☐	☐	☐	☐
2. Roads meet grade specs	☐	☐	☐	☐
3. Rutting within allowable specs	☐	☐	☐	☐
4. Well drained with appropriate structures	☐	☐	☐	☐
5. Ditches do not dump into streams	☐	☐	☐	☐
6. Roads reshaped and/or stabilized	☐	☐	☐	☐
Section Total =				
Percent Compliance =				

BMPs ☐ RD ☐ BD ☐ RE ☐ RF
Present ☐ CU ☐ RP ☐ WD ☐

IV. Skid Trails/Temporary (Secondary) Roads

	YES	NO	NA/NN	Sig. Risk
1. Slopes less than 15%	☐	☐	☐	☐
2. Respect sensitive areas	☐	☐	☐	☐
3. Water control devices present and working	☐	☐	☐	☐
4. Rutting within allowable specs	☐	☐	☐	☐
Section Total =				
Percent Compliance =				

BMPs ☐RD ☐BD ☐WB ☐RE ☐RF
Present ☐CU ☐RP ☐WD ☐TP ☐RV

V. Stream Crossings

	YES	NO	NA/NN	Sig. Risk
On Permanent Roads				
1. Crossing correct	☐	☐	☐	☐
2. Stabilized	☐	☐	☐	☐
3. Stream free of sediment	☐	☐	☐	☐
4. Number of crossings minimized	☐	☐	☐	☐
On Temporary Roads				
1. Number of crossings minimized	☐	☐	☐	☐
2. Stream crossings correct	☐	☐	☐	☐
3. Stream crossings restored and stabilized	☐	☐	☐	☐
4. Stream free of sediment	☐	☐	☐	☐
BMPs Present ☐ CU ☐ BR ☐ LW — Section Total =				
Percent Compliance =				

VI. Streamside Management Zones

	YES	NO	NA/NN	Sig. Risk
1. Present on permanent stream	☐	☐	☐	☐
2. Present on intermittent stream	☐	☐	☐	☐
3. SMZ adequately wide	☐	☐	☐	☐
4. Thinning within allowable specs	☐	☐	☐	☐
5. SMZ integrity honored	☐	☐	☐	☐
6. Stream clear of debris	☐	☐	☐	☐
7. SMZ free of roads and landings	☐	☐	☐	☐
8. Stream free of sediment	☐	☐	☐	☐
Section Total =				
Percent Compliance =				

VII. Site Preparation

Site Prep Method [ ]

Regeneration Method [ ]

	YES	NO	NA/NN	Sig. Risk
1. Respect sensitive areas	☐	☐	☐	☐
2. No soil movement on site	☐	☐	☐	☐
3. Firebreak erosion controlled	☐	☐	☐	☐
4. SMZ integrity honored	☐	☐	☐	☐
5. Chemicals applied correctly	☐	☐	☐	☐
6. Stream free of sediment	☐	☐	☐	☐
Section Total =				
Percent Compliance =				

VIII. Landings

	YES	NO	NA/NN	Sig. Risk
1. Locations free of oil and trash	☐	☐	☐	☐
2. Located outside of SMZ	☐	☐	☐	☐
3. Well drained location	☐	☐	☐	☐
4. Number and size minimized	☐	☐	☐	☐
5. Respect sensitive areas	☐	☐	☐	☐
6. Restored/stabilized	☐	☐	☐	☐
Section Total =				
Percent Compliance =				

IX. Wetlands (may or may not be jurisdictional)

	YES	NO	NA/NN	Sig. Risk
1. Avoid altering hydrology of site	☐	☐	☐	☐
2. Road drainage structures installed properly	☐	☐	☐	☐
3. Mandatory road BMPs followed	☐	☐	☐	☐
Section Total =	☐	☐		☐
Percent Compliance =				

Subjective Rating

Needs Improvement — Pass

☐ No Effort ☐ Poor ☐ Fair ☐ Good ☐ Excellent

Follow-Up Questions

	YES	NO	NA/NN
• Was the activity supervised by the landowner or representative? Who?	☐	☐	☐
• Was the landowner familiar with BMPs?	☐	☐	☐
• Was the logger familiar with BMPs?	☐	☐	☐
• Has the logger attended a BMP workshop?	☐	☐	☐
• Were BMPs included in the contract?	☐	☐	☐
• Is landowner a member of OFA, another landowner association or other group? If yes, list below. Organization	☐	☐	☐
• Does landowner plan remediation (if needed)?	☐	☐	☐

Comments (Explain discrepancies observed in the field check. Make recommendations for better compliance.)

Map/Sketch Area (use back if needed)

Evaluation Criteria for BMP Monitoring Checklist
Oklahoma Forestry Services BMP Compliance Monitoring Project

I. GENERAL LANDOWNER & TRACT INFORMATION

1. COUNTY:
2. TOWNSHIP & RANGE:
3. LATITUDE:
4. LONGITUDE:
5. FORESTER TYPE: Consulting, industry, state, etc.
6. FORESTER: Name
7. TIMBER BUYER: Name
8. LOGGING/SITE PREP CONTRACTOR: Name
9. ACTIVITY: Clearcut, select cut, site prep, etc.
10. ACRES AFFECTED:
11. ESTIMATED DATE OF ACTIVITY: year/quarter
12. DATE OF INSPECTION:
13. INSPECTOR: Name
14. ACCOMPANIED BY: Name
15. LANDOWNER TYPE: (N) NIPF, (A) Absentee, (I) Industry, (P) Public
16. LANDOWNER: Name
17. LANDOWNER: Address
18. CITY:
19. STATE:
20. ZIP CODE:
21. TELEPHONE NUMBER:

II. SITE CHARACTERISTICS

1. TERRAIN: Flat, Hilly or Steep
2. ERODIBILITY HAZARD: Low, Medium or High
3. TYPE STREAM PRESENT: Perennial or Intermittent
4. DISTANCE TO NEAREST PERMANENT WATER: Check on topographic map
5. PREDOMINANT SOIL ASSOCIATION/TEXTURE: Sand, clay, clay-loam, etc.
6. ROCK OUTCROPPINGS PRESENT: Yes or no.

III. PERMANENT ROADS

1. RESPECT SENSITIVE AREAS: Avoid wet areas, SMZs, steep slopes, erosion prone areas, if an alternative exists.
2. ROADS MEET GRADE SPECS: New or reworked roads only. Less than 15% grade except for short distances? Substantially on contour? Are ridge tops avoided?
3. RUTTING WITHIN ALLOWABLE SPECS: Is the road free of ruts in excess of 6 inches deep for more than 50 feet?
4. WELL DRAINED WITH APPROPRIATE STRUCTURES: Will water quickly drain to minimize soil movement?
5. DITCHES DO NOT DUMP INTO STREAMS: Do waterbars and wing ditches vent far enough from streams to allow sediment to settle before reaching the stream channel?
6. ROADS RESHAPED AND/OR STABILIZED: If needed, are roads reworked to minimize soil movement?
7. BMPs PRESENT: Which types of BMPs were used? Rolling dip (RD), Broad-based dip (BD), Relocated segment (RE), Rocked ford (RF), Culvert (CU), Road profile - in-sloped, out-sloped, crowned (RP), Wing ditch (WD).

IV. SKID TRAILS/TEMPORARY (SECONDARY) ROADS

1. SLOPES LESS THAN 15%: Are skid trails on or near contour rather than up and down steep slopes except for short distances?
2. RESPECT SENSITIVE AREAS: Are wet areas avoided, as well as SMZs, steep slopes and erosion prone areas?
3. WATER CONTROL DEVICES PRESENT AND WORKING: Were BMPS installed effectively to reduce erosion?
4. RUTTING WITHIN ALLOWABLE SPECS: Are skid trails and temporary roads free of ruts in excess of 6 inches deep for more than 50 feet?
5. BMPs PRESENT: Rolling dip (RD), Broad-based dip (BD), Water bar (WB), Relocated segment (RE), Rocked ford (RF), Culvert (CU), Road profile (RP), Wing ditch (WD), Traffic preventer (TP), Revegetate (RV).

V. STREAM CROSSINGS

ON PERMANENT ROADS

1. CROSSING CORRECT: Is the crossing at right angle to the stream, is the culvert a proper size, is there minimal impact to the SMZ?
2. STABILIZED: Are streambed and banks stable enough for the traffic?
3. STREAM FREE OF SEDIMENT: Is the crossing contributing sediment?
4. NUMBER OF CROSSINGS MINIMIZED: Was an effort made to use as few crossings as possible?

ON TEMPORARY ROADS

5. NUMBER OF CROSSINGS MINIMIZED: Was an effort made to use as few crossings as possible?
6. STREAM CROSSINGS CORRECT: Is the crossing located to minimize potential erosion, is stream crossed at right angle?
7. STREAM CROSSINGS RESTORED AND STABILIZED: Has the crossing been removed, excess fill removed and banks stabilized, and runoff diverted from stream channel?
8. STREAM FREE OF SEDIMENT: Is the crossing contributing sediment?
9. BMPs PRESENT: Culvert (CU), Bridge (BR), Low water crossing (LW)

VI. STREAMSIDE MANAGEMENT ZONES

1. PRESENT ON PERMANENT STREAM: Is there an SMZ present on all permanent streams?
2. PRESENT ON INTERMITTENT STREAM: Is there an SMZ present on all intermittent streams?
3. SMZ ADEQUATELY WIDE: Does the width protect the stream from sediment? A 50 ft. minimum is recommended.
4. THINNING WITHIN ALLOWABLE SPECS: A minimum basal area of 50 square feet or 50% crown cover remaining is recommended.
5. SMZ INTEGRITY HONORED: Is there minimal skidding damage, good stream bank stability, and an intact forest floor?
6. STREAM CLEAR OF DEBRIS: Have the tops and limbs or any pushed-in debris been removed from the stream channel?
7. SMZ FREE OF ROADS AND LANDINGS: If present, were they unavoidable and of minimal impact?
8. STREAM FREE OF SEDIMENT: Did action in the SMZ contribute sediment?

VII. SITE PREPARATION

SITE PREPARATION METHOD: Shear, pile, burn, rip, inject, etc.
REGENERATION METHOD: Machine plant, hand plant, seed, etc.

1. RESPECT SENSITIVE AREAS: Were wet areas, very steep slopes and highly erosive soils avoided?
2. NO SOIL MOVEMENT ON SITE: Is there any soil movement due to site preparation work?
3. FIREBREAK EROSION CONTROLLED: Are erosion control devices present and working?
4. SMZ INTEGRITY HONORED: Has site preparation work been kept out of the SMZ?
5. CHEMICALS APPLIED CORRECTLY: Were chemicals used according to directions and have the chemicals not entered a stream?
6. STREAM FREE OF SEDIMENT: Did site prep and/or planting activities contribute to sediment in the stream?

VIII. LANDINGS

1. LOCATIONS FREE OF OIL AND TRASH: Are there any oil spills and has trash been properly disposed of?
2. LOCATED OUTSIDE OF SMZ: Did the location minimize traffic and erosion in the SMZ?
3. WELL-DRAINED LOCATION: Were landings located in order to minimize puddling, compaction and soil movement?
4. NUMBER AND SIZE MINIMIZED: Were the number and size of the landings kept to a minimum?
5. RESPECT SENSITIVE AREAS? Were landings kept out of wet areas, very steep slopes and highly erodible soils?
6. RESTORED/STABILIZED: Has water been diverted, ruts smoothed and the area covered with slash and seeded where necessary?

IX. WETLANDS (may or may not be jurisdictional)

1. AVOID ALTERING HYDROLOGY OF SITE: Were ruts and soil compaction kept to a minimum?
2. ROAD DRAINAGE STRUCTURES INSTALLED PROPERLY: Was soil movement minimized?
3. MANDATORY ROAD BMPs FOLLOWED: If jurisdictional, 15 federal mandatory BMPs apply.

OVERALL COMPLIANCE

COMPLIANCE PERCENTAGES: The percentages of compliance in each category and overall are determined by dividing the number of questions receiving a yes answer by the total number of applicable questions: Y/(Y+N).

SIGNIFICANT RISK: A significant risk to water quality exists if, during normal rainfall, sediment is likely to be delivered to a permanent water body. All Yes/No questions also ask for “Significant Risk” to be assessed if the answer is “No.”

SUBJECTIVE SCORE

PASS

EXCELLENT: BMPs installed correctly, guidelines followed. Extra care evident. Few if any problems evident.

GOOD: BMPs generally installed correctly. Guidelines generally followed. Allows for some failures of BMP devices or failure to implement but with light consequences, OR good quality job which requires few BMPs and has few problems.

FAIR: Generally a pretty good effort at BMPs. Perhaps poor application/construction. Lack of some category of BMPs but with moderate consequences.

NEEDS IMPROVEMENT

POOR: Some effort at installing BMPs. Generally poor construction or no effort in some categories that are causing impacts. Substantial lack of BMPs in a particular category. Moderate to major consequences to water quality.

NO EFFORT: Poor attitude about the job. Largely no evidence of BMPs. Substantial erosion. Sediment in streams.

FOLLOW-UP QUESTIONS

DID LANDOWNER OR REPRESENTATIVE SUPERVISE ACTIVITY?

WAS LANDOWNER FAMILIAR WITH BMPs?

WAS LOGGER FAMILIAR WITH BMPs?

HAS LOGGER ATTENDED A BMP WORKSHOP?

WERE BMPs INCLUDED IN THE CONTRACT?

IS LANDOWNER A MEMBER OF A FOREST LANDOWNER GROUP? (e.g., Oklahoma Forestry Association, Oklahoma Woodland Owner's Association, Forest Farmer, etc.)

IS REMEDIATION PLANNED BY LANDOWNER (if needed)?

COMMENTS

Explain discrepancies, make general comments, provide recommendations, etc.

Summary of BMP Compliance Monitoring Checklist Data on All Sites

I. General Landowner and Tract Information

Owner Type		Forester Type		Activity	
NIPF & Corporate	50	Industry & Corporate	50	Clearcut	45
NIPF-Absentee	17	Private Consultant	15	Partial harvest	38
Industry	24	Public	12	First thinning	14
USFS Public	9	None	23	Site prep only	3

II. Site Characteristics

Terrain		Erodibility Hazard		Rock Outcroppings Present	
Flat	12	Low	40	Yes	29
Hilly	67	Medium	58	No	71
Steep	21	High	2		

Type of Stream Present		Dist. to nearest permanent water		Predominant soil series/texture			
Perennial Only	11	< 300’	27	Clay	2	Sandy loam	25
Intermittent Only	47	300-800’	6	Clay loam	66	Sand	0
Both	16	800-1600’	15	Loam	7		
None	26	> 1600’	52				

III. Permanent Roads (77 sites)	Yes	No	NA/NN	Significant Risks
Respect sensitive areas	77	0	23	0
Roads meet grade specs.	17	0	83	0
Rutting within allowable specs.	77	0	23	0
Well drained with appropriate drainage structures	59	18	23	0
Ditches do not dump into streams	21	0	79	0
Roads reshaped and/or stabilized	61	16	23	0

IV. Skid Trails, Temporary Roads (97 sites)	Yes	No	NA/NN	Significant Risks
Slopes less than 15%	76	21	3	0
Respect sensitive areas	89	8	3	0
Water control devices present and working	48	45	7	1
Rutting within allowable specs.	84	13	3	0

V. Stream Crossings (25 total sites, 3 had both)				
On Permanent Roads (11 sites)	Yes	No	NA/NN	Significant Risks
Crossings correct	11	0	89	0
Stabilized	11	0	89	0
Stream free of sediment	11	0	89	0
Number of crossings minimized	11	0	89	0
On Temporary Roads (17 sites)				
Number of crossings minimized	17	0	83	0
Stream crossings correct	14	3	83	0
Stream crossings restored and stabilized	11	6	83	2
Stream free of sediment	16	1	83	0

VI. Streamside Management Zones (74 sites)	Yes	No	NA/NN	Significant Risks
Present on permanent stream	27	0	73	0
Present on intermittent stream	62	0	38	0
SMZ adequately wide	65	8	27	0
Thinning within allowable specs.	68	5	27	0
SMZ integrity honored	73	0	27	0
Stream clear of debris	73	0	27	0
SMZ free of roads and landings	70	3	27	0
Stream free of sediment	72	1	27	0

VII. Site Preparation (32 sites)	Yes	No	NA/NN	Significant Risks
Respect sensitive areas	30	2	68	1
No soil movement on site	31	1	68	0
Firebreak erosion controlled	4	4	92	1
SMZ integrity honored	18	4	78	0
Chemicals applied correctly	3	0	97	0
Stream free of sediment	21	1	78	0

VIII. Landings (97 sites)	Yes	No	NA/NN	Significant Risks
Locations free of oil and trash	96	1	3	0
Located outside of SMZ	71	3	26	0
Well-drained location	96	1	3	0
Number and size minimized	97	0	3	0
Respect sensitive areas	93	4	3	0
Restored / stabilized	94	3	3	0

IX. Wetlands (1 site)	Yes	No	NA/NN	Significant Risks
Avoid altering hydrology of site	1	0	99	0
Road drainage structures installed properly	0	0	100	0
Mandatory road BMPs followed	0	0	100	0

X. Overall BMP Compliance (100 sites)	Yes	No	NA/NN	Significant Risks
Permanent Roads – 90%	312	34	254	0
Skid Trails and Temporary Roads – 77%	297	87	16	1
Stream Crossings – 91%	102	10	688	2
Streamside Management Zones – 97%	510	17	273	0
Site Preparation – 90%	107	12	481	2
Landings – 98%	547	12	41	0
Wetlands – 100%	1	0	299	0
Total of All Practices – 91.6%	1,876	172	2,052	5

Follow-up Questions	Yes	No	NA	Unknown
Forester involved in the activity?	77	23	0	0
Activity Supervised by Landowner or Rep.?	87	13	0	0
Landowner familiar with BMPs?	87	13	0	0
Contractor familiar with BMPs?	90	10	0	0
Logger attend a BMP workshop?	86	14	0	0
BMPs included in timber sale contract?	86	14	0	0
Landowner member of forestry organization?	57	34	0	9