SOUTH DAKOTA
SILVICULTURE BEST MANAGEMENT PRACTICES
AUDIT PROJECT FINAL REPORT

IMPLEMENTATION MONITORING AND EVALUATION

Black Hills Forest Resource Association
2040 W. Main Street, Suite 315
Rapid City, SD 57792

605-341-0875

This project was partially funded by a
Clean Water Act Section 319 Grant provided through the
South Dakota Department of Environment and Natural Resources

Report prepared by W. Kenneth Lee, RPF #46, CF and Aaron Everett

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EXECUTIVE SUMMARY

The South Dakota Silviculture Best Management Practices (BMP) audit was developed and completed to evaluate if forestry BMPs are being applied, and if so, whether they are effectively reducing, controlling or limiting non-point source pollution. The South Dakota audit process is modeled after the State of Montana's program. Montana has more than eight years of experience with siliviculture audit procedures and rating systems. Information was also provided by the State of Wyoming, which is in its second year of using a similar system. This report summarizes the findings of South Dakota's first forestry BMP audits, which were completed during June 2001.

The audit team was comprised of fisheries biology, wildlife biology, soil science, engineering, silviculture, geology, and logging equipment specialists. The team evaluated six timber harvest sites, two USFS, one South Dakota State Park, and three private parcels, for BMP application and effectiveness. Most harvest sites had one instance where the BMP application and or effectiveness were inadequate. For the majority of the sites, these departures were minor and did not result in erosion or deliver sediment to a nearby stream or waterway. The most frequently encountered departures in the Black Hills area were unimproved low water crossings and improper bedding and sizing of culvert pipes (CMP). Also, streamside management zones (SMZ) were not adequately designated on the ground. The team felt these departures allowed for minor and temporary displacement of soils and need to be addressed. On average, the BMPs met or exceeded 82 and 84 percent of the total rated points for application and effectiveness, respectively. Instances of gross neglect were not identified at any of the audited sales.

Two areas chosen for audit evaluation were unique and offered challenges to the team. The first was the State Park Sale (Lame Johnny); the other the USFS Jasper Salvage (Crawford Timber Sale,). The Lame Johnny sale was selected because it had special recreational and wildlife considerations. On this sale, free-ranging wildlife were the largest cause of soil erosion; large game animals chose to water, roll, and dust themselves near sediment control structures, which resulted in considerable damage to the structure. On the Crawford sale, located within the 83,508-acre Jasper Burn, ash and other burned material washed from hillsides presented special concerns. Here, the team's specialists viewed how sound management can aid in the recovery of fire killed timber areas, protect natural resources, and reduce pollution by spreading woody material across the hillsides and breaking the charred soil surface to improve water infiltration and abate excessive runoff.

The team concluded that South Dakota's Silviculture BMPs are being properly installed and are effective. However, improvements are still needed and continuing education, along with revisions to the BMP handbook, will aid in reaching even higher water quality standards. Among these improvements are developing simple systems for calculating culvert size and proper positioning of culverts and other cross drainage structures. Another issue is the difference in SMZ characteristics between the Northern Hills' narrow wet drainages and the flat, wide, dry-bottom draws found in the Southern Hills. A standard that addresses these differences is needed to improve SMZ designation and design. The team also recommends that some additional discussion of soil erosion potential should be included with the BMP handbook.

ACKNOWLEDGEMENTS

During June 2001, the Black Hills Forest Resource Association (BHFRA) and South Dakota Department of Environment and Natural Resources (DENR), with the aid of local scientists and timber industry professionals completed a field audit water of quality of best management practices (BMPs) on selected timber harvest areas within the Black Hills. This was the first siliviculture BMP audit to be conducted in South Dakota. Special thanks must be given to Dennis Clarke, of DENR and Greg Josten, of the State Department of Agriculture, Division of Forestry for their help, direction and guidance. Many other individuals from several specialized disciplines gave time and professional services to complete the weeklong field audits. This was the first silviculture BMP audit to be conducted in South Dakota. The following people gave of their professional time to evaluate the applied practices of the *South Dakota Forestry Best Management Practices (BMPs); Forest Stewardship Guidelines for Water Quality*. Dr. Larry Stetler of the South Dakota School of Mines and Technology developed a web page to document the BMP audit week using text and pictures. This was the first time the silviculture BMP results were electronically distributed, and many public responses were received because of his greatly appreciated work on this project. To view the audit week review, please visit http://www.hpcnet.org/timberaudit.

AUDIT TEAM

Larry Stetler	SD School of Mines and Technology – Geologist
Paul Schipke	American Tree Farmer
Walt Schaefer	NRCS – Soils
Ron Koth	SD GFP – Fishery
Gene Norman	Logging Specialist
Shelly Deisch	SD GFP – Wildlife
Gary Say	USFS – Forester
Ernie Nauman	USFS – Engineer
Alan Wittmuss	SD DENR – Environmental Scientist

INTRODUCTION

The ponderosa pine forests of the Black Hills have supported the logging and sawmill industry in western South Dakota for 110 years. The welfare of nearly 2000 families is closely linked to the forest industry. The Black Hills are located on the extreme western edge of South Dakota. One-fourth of the Black Hills is shared with the State of Wyoming. This up-lift of mountains, as viewed from a satellite, takes the shape of a football 110 miles long and 60 miles at its center. Elevation of the Black Hills ranges from 3000 to over 7200 feet above seal level. Most of this arid region's critical surface moisture comes from snow melt and summer thundershowers. Major tree species include ponderosa pine, spruce, aspen, and birch with the latter three occurring at higher elevations or areas with greater annual precipitation.

Water quality is of utmost importance everywhere, but especially in the Black Hills. Its watersheds act as recharge areas for several large regional aquifers. Principle among these are the Deadwood, Madison, Minnelusa, and Inyan Kara. Many cities and communities depend on these aquifers and surface water runoff for municipal water systems. Water from the Black Hills also drains into the Missouri and Mississippi Rivers. As such, the importance of water quality protection goes far beyond meeting State and Federal regulations and non-regulatory requirements. Water quality is everyone's business in South Dakota.

When designed into every timber harvest program, and if appropriately applied, BMPs limit nonpoint source pollution. The South Dakota audit process was developed to evaluate if the BMPs are being properly applied and assess their effectiveness at limiting nonpoint source pollution from silvicultural practices.

Objectives for 2001 South Dakota BMP Audit

- Determine if the BMP training offered by the Black Hills Women in Timber and DENR for Black Hills logging contractors is being applied to timber harvest operations in South Dakota.

- Evaluate the effectiveness of South Dakota Silviculture BMPs in protecting soil and water resources.

- Provide logging contractors, timberland owners, mills and the general public an opportunity for feed back to clarify and re-enforce the BMP principles.

- Assess future education needed to improve BMP training, condense the field rating guide, develop definitions that may impact nonpoint pollution (wetlands and surface zones of aquifers and recharge areas), and explore special geographical features that may need more specific consideration.

- Evaluate how streamside management zones (SMZ) should be sited and designated with regard to wet/dry springs in the Black Hills' arid ecology and identify a simplified system of identification and designation.

SOUTH DAKOTA SILVICULTURE BMP AUDIT PROCESS

Development of Audit Procedures:

The SD best management practices audit process was developed by a steering committee of resource professionals. It is based on a similar process that has been conducted by the State of Montana for the last eight years. The steering committee felt that conducting on-the-ground audits of BMP implementation was the best method to determine how effective the Black Hills Women in Timber Logger Education and Professionalism (LEAP) program had been. Project partners expanded over 660 hours and $10,350 toward making the South Dakota BMP project a success. The financial summary for South Dakota's BMP development and auditing is displayed in Appendix A.

Site Selection

The team selected the audit sites from maps of timber sales and other information provided by members of BHFRA and the U. S. Forest Service. Site selection was predisposed to bias because certain criteria were imposed in the selecting process. These criteria were:

- Harvest was completed within the last two years.
- A minimum of 2000 bd. ft. per acre was cut at the site.
- Harvest site has landings, temporary roads, and skid trails within a drainage.
- Harvest site must contain a stream or have significant water concerns.

The harvest activities completed within two years criterion was imposed as it allowed the team to assess the effectiveness of a BMP training program initiated two and half years ago by the Black Hills Women in Timber Association's LEAP program and SD DENR.

Six sites were chosen, three on private land, two on Forest service lands, and one area from the state lands (Figure 1). The audits were not designed to evaluate the entire harvest area. They were, instead, a spot check of silvicultural activities (timber harvest) considered to have characteristics that might generate nonpoint pollution.

The team was also interested in testing the BMP procedures on the Jasper fire area. The Forest Service's Jasper fire salvage operations on the Crawford Sale were perfect for the audit, given the special concerns relating to erosion after a fire event. The Lame Johnny Sale within Custer State Park was also of particular interest because of the nature of the management activities within a high use recreational area. Both of these areas presented challenges for the team given the definitions and scoring procedures featured in the rating guide.

SOUTH DAKOTA SILVICULTURE BMP AUDIT PROCESS

Rating System[1]

The team format for rating was adapted from Montana's audit format, which has proven itself over several years of successful use. Using this format also provides consistency with similar ongoing projects in other states across the nation and adds to its future usefulness.

The following criteria were selected for rating BMP application and effectiveness. A flow chart outlining the rating process using these criteria is shown in Figure 2:

APPLICATION:

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

EFFECTIVENESS:

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

Definitions:

Adequate:	Small amounts of material eroded. Material does not reach draws, channels or floodplains.
Minor:	Some material erodes and is delivered into dry draws, but not into a stream.
Major:	Material erodes and is delivered into stream or annual floodplain.
Temporary:	Impacts last less than one season.
Prolonged:	Impacts that last more than one year.

[1] REFERENCE: Source of audit categories to which the evaluation is applied.

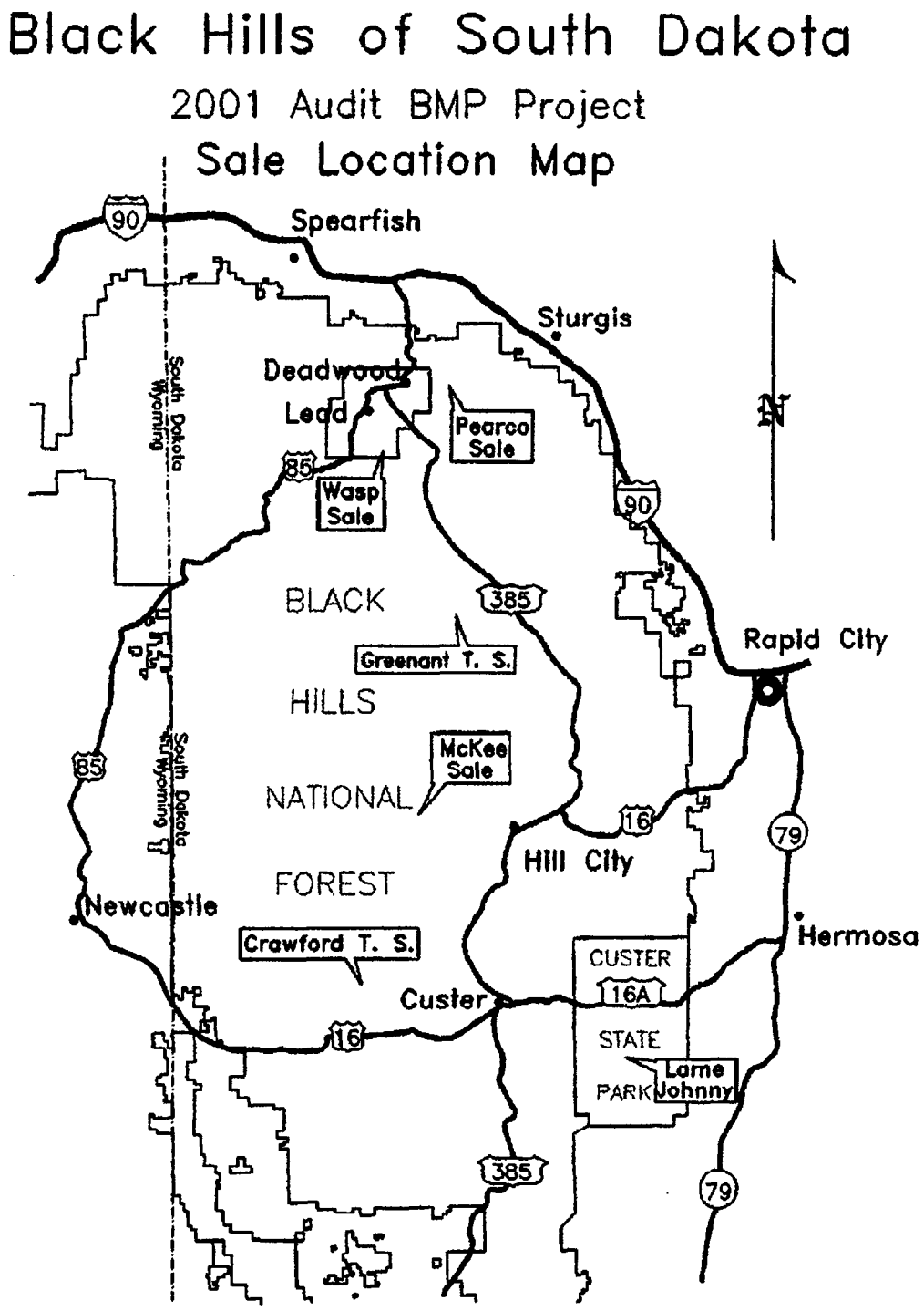

Figure 1. South Dakota BMP 2000-2001 Audited Sale Location Map.

SOUTH DAKOTA SILVICULTURE BMP AUDIT PROCESS

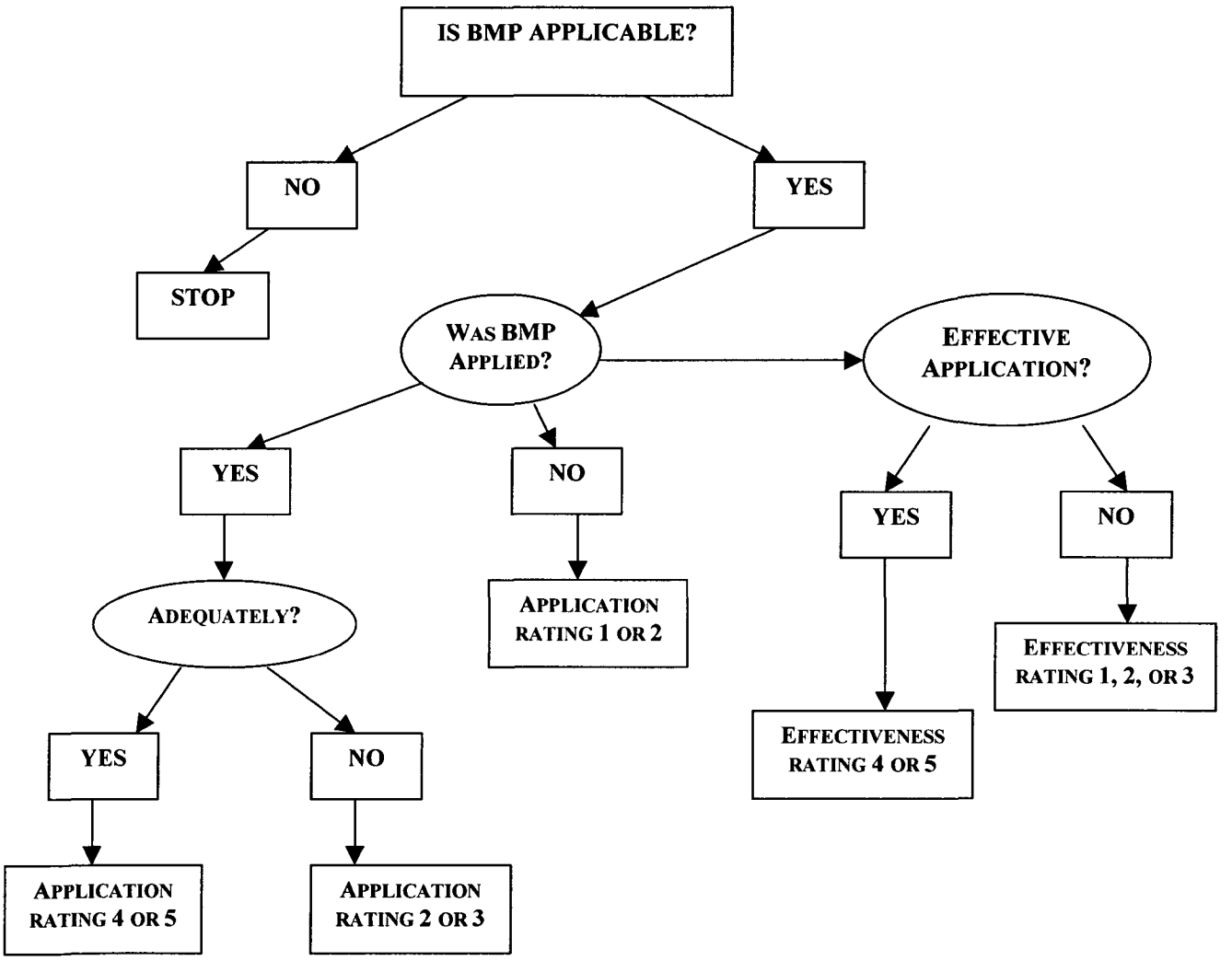

Figure 2. BMP Audit Procedure Flow-Chart.

SOUTH DAKOTA SILVICULTURE BMP AUDIT PROCESS

Audit Limitations:

It must be remembered that the team had a one time, quick review or spot check for assessment and documentation. However, erosion and sedimentation problems, or lack of, usually develop and occur in the initial season following harvest or during the second post harvest season; the period documented as the critical times for erosion.

Post harvest reviews such as BMP audits can easily identify and define potential erosion. The effect of some practices cannot be detected or evaluated at this post harvest audit period. All observations of any impact to the soil and water are a visual appraisal. The team can only reflect on what has been observed; not forecast future scenarios such as third party damage. All the rating scores represent a consensus among team members reached before leaving a site.

On some audited sites, the application of certain BMPs included in the *South Dakota Forestry Best Management Practices; Forest Stewardship Guidelines for Water Quality* handbook was not relevant. For example, activities such as new road construction and culvert installation are not always necessary and therefore are not installed on every sale.

BMPs relating to effects on water quality over very long periods of time could not be properly evaluated. The team observed grass mixtures that had been applied but had not sprouted, and sites where contractors had not yet seeded, electing instead to broadcast in early fall (September) with the expectation of better survival and coverage. Therefore, this stage of the audits could not be completed or rated in every case. The team cited instances where seeds were visible on the surface of the soil and sprouting had begun, but effectiveness could not be rated fairly. The BMP calls for prompt reseeding with grass mixtures to reduce erosion on disturbed areas, but other techniques may be applied, such as scattering woody material. All audited landowners had overlooked the use of annual grasses in stabilizing erodable areas. One effective alternative during suboptimal seeding conditions is the use of white oats, which are fast germinating and provide a good cover crop until weather conditions allow seeding with perennials

AUDIT RESULTS AND DISCUSSION

Tables 1 and 2 show the consensus ratings determined by the team for each ownership group. A total of 374 points were rated. Figures 3 and 4 show the percent breakdown of BMP compliance totaled across all ownerships.

BMP application (Table 1) was found to meet or exceed standards for 304 of the 374 individual BMPs points, representing an 82 percent compliance rate (Figure 3). Minor departures in application accounted for a total of 65 points, or 17 percent; major departures, five points, or one percent. No instances of gross neglect in BMP application were found at any of the audited sales.

Table 1. Combined South Dakota BMP Field Audit Application Data for 2001.

Ownership Group	Total Rated Points	Met or Exceeded BMP Standards	Minor Departure From BMP Standards	Major Departure From BMP Standards	Gross Neglect of BMP Standards
Private Sales	186	143	39	4	0
Federal Sales	188	161	26	1	0
Two-Year Total Average	**374**	**304**	**65**	**5**	**0**

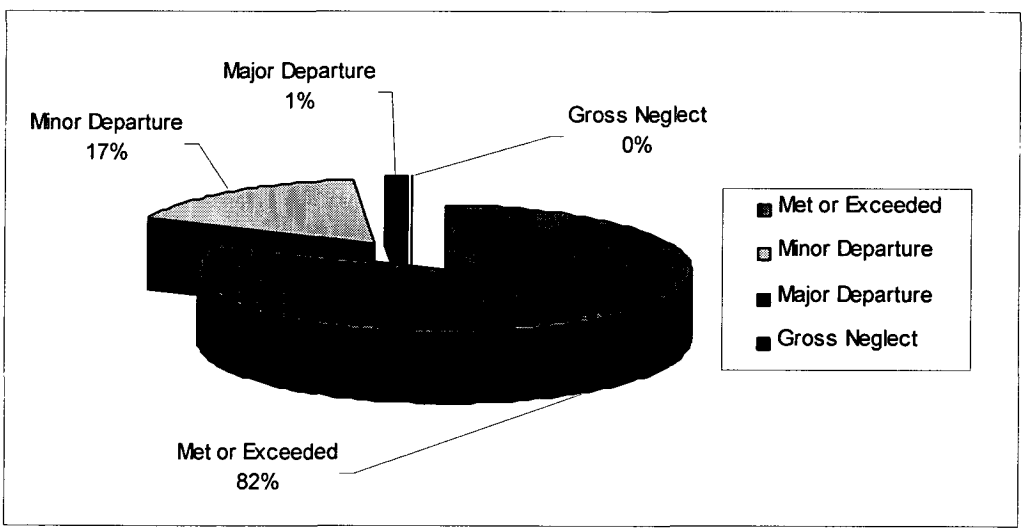

Figure 3. South Dakota BMP Application Compliance for All Audited Ownerships.

BMP effectiveness was found to have met or exceeded the standard on 317 or 84 percent of the 374 rating points (Table 2; Figure 4). No gross neglect in effectiveness was found. Minor departures were identified at 47 points (13 percent) and major departures at ten points (three percent). In these instances, the failure to designate an SMZ, not dewatering when installing a culvert, and not using siltation traps led to erosion problems. Improper culvert sizing and failure to remove a temporary plastic culvert pipe from a wetland were also considered major departures. The minor departures came from a lack of

AUDIT RESULTS AND DISCUSSION

Table 2. Combined South Dakota BMP Field Audit Effectiveness Data for 2001.

Ownership Group	Total Rated Points	Met or Exceeded BMP Standards	Minor Departure From BMP Standards	Major Departure From BMP Standards	Gross Neglect of BMP Standards
Private Sales	186	147	30	9	0
Federal Sales	188	170	17	1	0
Two-Year Total Average	**374**	**317**	**47**	**10**	**0**

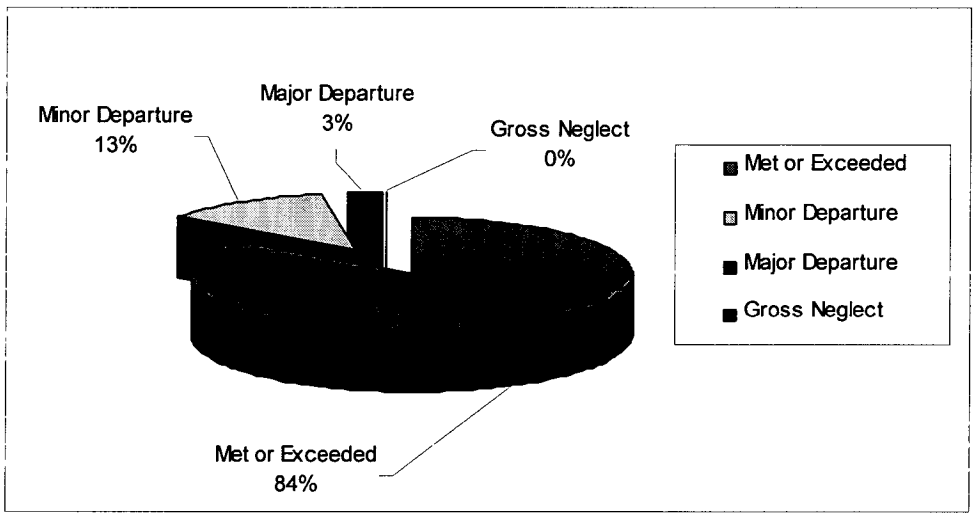

Figure 4. South Dakota BMP Effectiveness Compliance Breakdown for All Audited Ownerships.

Maintenance on erosion control features (rolling dips/water bars). Within a season the minor departures will stabilize. With major departures from the BMP, it may take one year for the site to stabilize. Most culvert placement in streams with running water had been installed with the inlet or outlet too high for fish passage. Contractors failed to recognize that even small streams have aquatic life whose movement can be impeded by an incorrect culvert installation.

The full summary of audit data, broken down by ownership category and audit rating guide item, is presented in Table 5. A score of 1.00 indicates that the harvester went beyond BMP requirements and improved resource needs. Scores of 1.0 to 0.81 exceed the BMP standards. Scores of 0.80 to 0.61 meet the BMP standards. Scores of 0.60 and below indicate a departure from the BMP standards. Complete audit data for all sales individually is located in Appendix B.

AUDIT RESULTS AND DISCUSSION

Table 5. Summary and Comparison of Audit Results by Ownership Category and BMP Rating Guide Item.

RATING 1.00 SCORE WENT BEYOND BMP REQUIREMENT AND IMPROVED RESOURCE NEEDS; 0.80 = MEETING REQUIREMENT; 0.60 MINOR DEPARTURE FROM BMP's & RESOURCE NEEDS	BLACK HILLS N. F. SD PORTION ONLY		PRIVATE SALES COMBINED		STATE OF SD CUSTER ST. PARK	
	Application score	Effectiveness score	Application score	Effectiveness score	Application score	Effectiveness score
ROADS						
A. Planning and Location						
1. Minimize number of roads in Watershed						
2. Use consultant and pertinent information						
3. Fit roads to topography						
4. Locate on stable geology						
5. Locate roads at safe distance from SMZ						
6. Minimize number of SMZ crossings						
7. Roads in relations to suitable log landings						
SUBTOTAL	0.75	0.78	0.77	0.76	0.92	0.88
B. Design						
1. Proper Drainage Facilities						
2. Minimum standard for intended use						
3. Use of balanced cut and fills						
4. Minimum disturbance of drainage						
5. CMP - SMZ - Adequate for fish passage/ 25yr. Impact event						
SUBTOTAL	0.78	0.80	0.73	0.69	0.80	0.80
C. Surface Drainage						
1. Adequate drainage for all roads						
1a. Outsloped						
1b. Insloped						
1c. Drain dips						
2. CMP installed at 20-30% Protect from plugging						
3. Install ditch relief /armor or anchor outlets						
4. Provide energy dissipaters where needed, all structures and cross drains						
5. Prevent sediment movement downslope, catch basin, headwall,etc.						
6. Install road drainage before SMZ or route through, use filter fields						
SUBTOTAL	0.80	0.77	0.78	0.76	0.60	0.60
D. Construction						
1. Prudent and current use of erosion controls						

2. Stabilize prior to fall/spring runoff periods 3. Use of slash/debris in low compact row at toe of potential erodable fill 4. Minimize use of equipment during periods soils are excessively wet 5.Cut/fills at stable angle of repose 6. Avoid incorporating unstable woody matter in fills 7. Surfacing provided to minimize erosion or (considered) 8. Overburden/other waste located away from SMZ and stabilization used 9. Precautions to reduce sediment from barrow/gravel pits 10. Existing road use-provide erosion measures/ leave stable surfaces						
SUBTOTAL	0.79	0.80	0.75	0.77	0.80	0.80
E. Maintenance 1. Use minimum maintenance necessary 2. Maintain all erosion features 3. Avoid uncutting cut slopes 4. Provide drainage breaks in all snow berms throughout winter periods 5. Avoid sidecast into SMZ, excessive waste in safe areas and stabilized 6. Avoid road use during wet periods when damage to drainages likely 7. Practice seasonal maint. Clean and check all drains, to protect surfaces 8. Abandon roads, close off, provide proper erosion controls/recontour						
SUBTOTAL	0.80	0.80	0.74	0.75	0.70	0.70
TIMBER HARVESTING, STREAMSIDE MANAGEMENT, AND SITE PREPARATION **A. Timber Harvest** 1. Timber harvest planning and objectives, water quality, land owner's 2. Select proper logging equip. for soil/ topography 3. Selected yarding system to minimize road densities 4. Use of log forwarding equipment 5. Design and locate skid trails to minimize erosion 6. Locate skid trails, avoid concentration of runoff, limit grade, waterbar 7. Size and number of landings minimized, avoid skids across SMZ						
SUBTOTAL	0.78	0.90	0.74	0.80	0.77	0.80
B. Streamside Management (SMZ) 1. Designate SMZ to provide for its protection, 50 ft. both side of live stream 2. a. Retention of hardwoods, seed trees, shrubs, etc. b. Protect stream banks, save future larger woody material c. Restrict clearcutting along SMZ (<600 ft.)						

d. Recognize soil/drainage potential that can raise water table e. Provide for ground cover as sediment traps/whole tree or tree length f. Protection given to steep slopes, rolling material into SMZ g. Slash free zones to maximize streamside veg. if burning to be used h. Hand treatment of slash/slash left above high water mark I. Landings in SMZ, prevent debris/sediment from entering stream 3. Minimize use of equip. within the SMZ 4. Directional felling in SMZ/wet lands, avoid felling or slash into streams 5. Suspend lead end of log, end-line out of SMZ 6 Avoid decking within high water- marks or any stream						
SUBTOTAL	0.74	0.76	0.77	0.80	0.74	0.80
C. Other Harvesting Activities 1. Minimize damage to soils when skidding, avoid highly erodible soils 2. Provide and maintain drainage on all trails 3. Install required function water-bars with appropriate placement/distance 4. Seed/slash in all disturbed areas that lack adequate veg. cover						
SUBTOTAL	0.80	0.80	0.78	0.78	0.80	0.80
D. Slash Treatment/Site Preparations 1.Plan for rapid reforestation 2. Abide by SD Codified Slash Regulations 21-10-26,27 and ARSD 12:02 3. Provide top soil protection by use of brush blades/piling 4. Minimize up/down slope scarification 5. Minimize soil scarification for regen. Leave scattered slash for protection. 6. Brush piling (Dry or Frozen) soils 7. Use of proper techniques to minimize erosion during scarification 8. Reclaim/stabilize landings/temporary roads 9. Remove all machinery debris/dispose of properly off site 10. Limit water quality impacts of prescribed fire w/use of erosion measures						
SUBTOTAL	0.78	0.80	0.80	0.80	0.80	0.80
STREAMSIDE MANAGEMENT **A. Stream Crossings - Legal Requirements dealing with pollution of streams** D.E.N.R. SDCL 34A-2-33, AND 34,34A-2-11, AND 34A-2-93 SURFACE WATERS SD **B. Design Considerations for Roads/Cross drainage facilities** 1. Stream crossings designed at 90 deg. To main channel						

2. Avoid unimproved stream crossings/drive through on stable areas						
SUBTOTAL	0.69	0.70	0.70	0.73	0.73	0.87
C. Installations of stream crossings						
1. Minimize stream channel disturbance; use of strawbales. silt fencing						
2. Culvert installed correctly/fish may pass easily through						
3. Culvert installed to prevent erosion of fill/compacted/armored						
4. De-water (dammed/pumped/by-passed) at installation						
5. Correct amount of fill over culvert (1 ft. for 18-36 in dia. Pipe)						
6. Min. 15 inch culvert for permanent stream crossings/cross drains						
SUBTOTAL	0.75	0.80	0.60	0.60	0.63	0.67
WINTER LOGGING						
A. General Directions						
1. Consider "snow-roads" on wet sites						
2. Conduct operations when ground frozen or snow covered						
3. Use experienced contractor with winter logging experience						
SUBTOTAL	0.80	0.80	0.80	0.74	0.80	0.80
B. Road Construction and Harvesting Considerations						
1. Hauling during frozen period/remove snow and allow ground to freeze						
2. Mark culvert ends before deep snows						
3. Compact snow for roadways in unroaded, wet or sensitive sites						
4. Designate or mark stream courses prior to heavy deep snows						
5. Prior to felling, use equipment to compact snow for skid trails						
6. Follow prudent operations by returning early to complete erosion controls						
7. Leave no slash in stream channels						
SUBTOTAL	0.80	0.80	0.77	0.73	0.80	0.80
HAZARDOUS SUBSTANCES						
A & B. General Direction						
1. Comply with storage/disposal of H.S. per regulations (licensing/applica)						
2. Does not trans/store/load/dispose of in such a way as to pollute or harm.						
3. Has written plan for H.S. spills and notification listing names and number						
SUBTOTAL	0.77	0.80	0.71	0.80	0.80	0.80
C. Pesticides - NOT APPLICABLE (NA)						
OVERALL WEIGHTED RATING	**0.79**	**0.80**	**0.75**	**0.76**	**0.75**	**0.77**

RECOMMENDATIONS

The Team evaluated timber sales representative of the Black Hills forested area north to south; wet sites to dry sites. The group determined the BMPs are working, but that there is need for improvement. The following recommendations are offered to improve the BMPs used to protect the soil and water resources of the South Dakota Black Hills.

The team was enthusiastic from the beginning and with each additional sale visited. All agreed that it was evident that South Dakota Forestry BMPs were being used by logging contractors and sale administrators.

BMP Audits and Rating Guide

- Continue interdisciplinary BMP audits on a two-year cycle.
- Improve the site selection process through centralized data collection on completed sales and sale details independent of bias.
    - This could be accomplished through the implementation of a selection committee or task force.
    - Centralized data could be obtained by amending the State's slash law to include contractor registration or permitting.
    - Where practical, sale selections should include spring, summer, and fall harvesting sites.
    - 2001 sales audited on private land were harvested by one corporation; in the future, a more objective practice would be to include sales harvested by more than one corporation.
- Revise the rating guide to fewer but more pertinent questions.
- Formally involve non-industry forest landowners in the South Dakota Forestry BMP Program.
    - This could be accomplished through the LEAP program.
- An effective and practical BMP team would include a soil scientist, hydrologist, forester, engineer, a fish or wildlife biologist, the landowner or representative, the logging contractor/road builder, and an administrating forester where applicable.
    - Suggested activities to increase landowner participation include an introductory or informational letter, and timing the sale's audit so that they are able to attend.

BMP Training Package and Guide

- Update BMP training package and provide additional training for loggers, equipment operators, road builders, foresters, and landowners on the following:
    - Develop a clear statement of purpose for the BMP guide.
    - "How to" determine culvert size, properly install culverts and maintain culverts.
        - While this item is currently included in the BMP guide, a more detailed explanation with further emphasis on the importance of these topics is needed.
    - "How to" build effective rolling dips, cross drains, and waterbars including a recommendation for ideal spacing between structures.
    - "How to" adequately close trails and temporary roads.
    - "How to" select appropriate grass seed mixtures for different soil types.

- Develop and incorporate noxious weed control standards.
- Include NRCS approved seed mixtures.
- Develop and incorporate BMPs for fire salvage logging situations.
- Refine the definition and recommendations in the BMP guide regarding SMZ management.
- Develop and incorporate an easily understood stream classification system.
- Include some means by which a landowner could contact foresters who could act as consultants in the sound forest management or simply provide more information about forestry in general.
- Include a glossary of terms.
- Landowners should be referred to the SD Department of Agriculture for information about pesticide application and licensing.

- Develop a process to remedy the occurrence of serious BMP departures.
- Actively encourage landowners, logging and road building contractors to attend BMP audits. At a minimum, provide formal audit training to contractor, landowner, South Dakota Department of Research Conservation and Forestry and South Dakota DENR.

APPENDIX A
SD BMP Financial Summary

SOUTH DAKOTA BMP MONITORING/EVALUATION
AMENDMENT "B" 9/20/00 SD DEN

TASK No.	BUDGET 319	BILLING 1 06/09/2001	BILLING 2 12/11/2001	BILLING 3	BILLING 4	REMAINING 319 FUNDS
1	$ -	$ -	$ -			
2	$ 250.00	$ 240.00	$ -			$ 10.00
3	$ 700.00	$ 227.20	$ -			$ 472.80
4	$ -	$ -	$ -			
5	$ 200.00	$ 200.00	$ -			$ -
6	$ 200.00	$ 480.00	$ -			$ (280.00)
7	$ 300.00	$ 316.80	$ -			$ (16.80)
8	$ 2,250.00	$ -	$ 2,482.46			$ (232.46)
9	$ 300.00	$ -	$ 300.00	Split $		$ -
10	$ 400.00	$ -	$ 318.86	Split $		$ 81.14
11	$ 500.00	$ -	$ 534.68			$ (34.00)
TOTAL	**$ 5,100.00**	$ 1,464.00	$ 3,636.00			**$ -**
GRANT %	49.28%					

TASK No.	BUDGET IN-KIND VAL.	EXPENDED		TASK No.	BUDGET OTHER FED.	EXPENDED
1	$ 500.00	$ 320.00		1	$ -	$ -
2	$ 50.00	$ 80.00		2	$ -	$ -
3	$ 750.00	$ 771.40		3	$ 300.00	$ -
4	$ 200.00	$ 160.00		4	$ -	$ -
5	$ 200.00	$ 702.20		5	$ 150.00	$ 209.55
6	$ 200.00	$ -		6	$ 150.00	$ -
7	$ 600.00	$ 704.64		7	$ 150.00	$ 135.75
8	$ 1,550.00	$ 5,416.56		8	$ 750.00	$ 2,588.60
9	$ 300.00	$ 200.00	Split $	9	$ 300.00	$ 398.80
10	$ 400.00	$ 239.60	Split $	10	$ 400.00	$ -
11	$ 500.00	$ 1,106.00		11	$ 500.00	$ -
TOTALS	**$ 5,250.00**	$ 9,700.40		TOTALS	**$ 2,700.00**	$ 3,332.70
GRANT	$ 5,100.00					
COMBINED	**$ 10,350.00**					

IN-KIND % 50.72% **$ 4,450.40**

Reported by Aaron Everett Dec. 11, 2001
Figures not audited by DENR

Black Hills Forest Resource Association
319 Grant
BEST MANAGEMENT PRACTICES
Total Expenditure Summary by Task

TASK #	319 Budget	319 Spent	NFIK Budget	NFIK Spent	Total Budget	Total Spent	Other Federal	FO Spent	Total w/Federal
1	$0.00	$0.00	$500.00	$320.00	$500.00	$320.00	$0.00	$0.00	$820.00
2	$250.00	$240.00	$50.00	$80.00	$540.00	$320.00	$0.00	$0.00	$860.00
3	$700.00	$227.20	$750.00	$771.40	$1,677.20	$998.60	$300.00	$0.00	$2,975.80
4	$0.00	$0.00	$200.00	$160.00	$200.00	$160.00	$0.00	$0.00	$360.00
5	$200.00	$200.00	$200.00	$702.20	$600.00	$902.20	$150.00	$209.55	$1,652.20
6	$200.00	$480.00	$200.00	$0.00	$880.00	$480.00	$150.00	$0.00	$1,510.00
7	$300.00	$316.80	$600.00	$704.64	$1,216.80	$1,021.44	$150.00	$135.75	$2,388.24
8	$2,250.00	$2,482.46	$1,550.00	$5,416.56	$6,282.46	$7,899.02	$750.00	$2,588.60	$14,931.48
9	$300.00	$300.00	$300.00	$200.00	$600.00	$500.00	$300.00	$398.80	$900.00
10	$400.00	$318.86	$400.00	$239.60	$800.00	$558.46	$400.00	$0.00	$1,200.00
11	$500.00	$534.00	$500.00	$1,106.00	$1,000.00	$1,640.00	$500.00	$0.00	$1,500.00
TOTAL	**$5,100.00**	**$5,099.32**	**$5,250.00**	**$9,700.40**	**$14,296.46**	**$14,799.72**	**$2,700.00**	**$3,332.70**	**$29,097.72**

APPENDIX B
Complete Field Data by Audited Sale

SD - Silviculture BMP Field Audit Data June 2001 1.00 SCORE WENT BEYOND BMP REQUIREMENTS AND IMPROVES RESOURCE .80 = MEETING REQUIREMENTS OF BMP's .60 MINOR DEPARTURES FROM BMP"S & RESOURCE NEEDS	WASP SALE INDUSTRIAL		PEARCO TREE FARMER		McKEE SALE PRIVATE OWNER		COMBINED SCORES			COMBINED SCORES		
	Application	Effective	Application	Effective	Application	Effective	Application	Possible	Actual	Effective	Possible	Actual
A. Stream Crossings - Legal Requirements dealing with pollution of streams												
DENR. SDCL 34A-2-33, AND 34,34A-2-11, AND 34A-2-93 SURFACE WATERS SD	4	4	3	4	3	4	10	15	0.67	12	15	0.80
B. Design Considerations for Roads/Cross drainage facilities												
1. Stream crossings designed at 90 deg. To main channel	3	3	0	0	4	4	7	10	0.70	7	10	0.70
2. Avoid unimproved stream crossings/drive through on stable areas	3	2	4	4	4	4	11	15	0.73	10	15	0.67
SUBTOTALS	10	9	7	8	11	12	28	40		29	40	
POTENTIAL SCORE	15	15	10	10	15	15			0.70			0.73
%	0.67	0.60	0.70	0.80	0.73	0.80						
C. Installations of stream crossings												
1. Minimize stream channel disturbance/sue of strawbales & silt fencing	3	4	0	0	2	3	5	10	0.50	7	10	0.70
2. Culvert installed correctly/fish may pass easily through	3	2	0	0	3	2	6	10	0.60	4	10	0.40
3. Culvert installed to prevent erosion of fill/compacted/armored	3	3	0	0	3	2	6	10	0.60	5	10	0.50
4. De-water (dammed/pumped/by-passed) at installation	0	0	0	0	3	3	3	5	0.60	3	5	0.60
5. Correct amount of fill over culvert (1 ft. for 18-36 in dia. Pipe)	3	4	0	0	3	3	6	10	0.60	7	10	0.70
6. Min. 15 inch culvert for permanent stream crossings/cross drains	3	3	0	0	4	4	7	10	0.70	7	10	0.70
SUBTOTALS	15	16	0	0	18	17	33	55		33	55	
POTENTIAL SCORE	25	25	0	0	30	30			**0.60**			**0.60**
%	0.60	0.64			0.60	0.57						
WINTER PERIOD LOGGING PERIODS												
A. General Directions												
1. Consider "snow-roads" on wet sites	4	4	4	3	4	4	12	15	0.80	11	15	0.73
2. Conduct operations when ground frozen or snow covered	0	0	4	3	4	4	8	10	0.80	7	10	0.70
3. Use experienced contractor with winter logging experience	0	0	4	4	4	4	8	10	0.80	8	10	0.80
SUBTOTALS	4	4	12	10	12	12	28	35		26	35	
POTENTIAL SCORE	5	5	15	15	15	15			**0.80**			**0.74**
%	0.80	0.80	0.80	0.67	0.80	0.80						
B. Road Construction and Harvesting Considerations												
1. Hauling during frozen period/remove snow and allow ground to freeze	0	0	4	3	4	4	8	10	0.80	7	10	0.70
2. Mark culvert ends before deep snows	0	0	0	0	4	4	4	5	0.80	4	5	0.80
3. Compact snow for roadways in unroaded, wet or sensitive sites	0	0	0	0	0	0	0	0		0	0	
4. Designate or mark stream courses prior to heavy deep snows	0	0	3	3	0	0	3	5	0.60	3	5	0.60
5. Prior to felling, use equipment to compact snow for skid trails	0	0	0	0	0	0	0	0		0	0	
6. Follow prudent operations by returning early to complete erosion controls	0	0	0	0	0	0	0	0		0	0	
7. Leave no slash in stream channels	0	0	4	4	4	4	8	10	0.80	8	10	0.80
SUBTOTALS	0	0	11	10	12	12	23	30		22	30	
POTENTIAL SCORE	0	0	15	15	15	15			**0.77**			**0.73**
%			0.73	0.67	0.80	0.80						
Hazardous Substances - Follow legal requirements												
A & B. General Direction												
1. Comply with storage/disposal of H.S. per regulations (licensing/applica)	3	4	0	0	0	0	3	5	0.60	4	5	0.80
2. Does not trans/store/load/dispose of in such a way as to pollute or harm.	4	4	3	4	4	4	11	15	0.73	12	15	0.80
3. Has written plan for H.S. spills and notification listing names and number	3	4	4	4	4	4	11	15	0.73	12	15	0.80
SUBTOTALS	10	12	7	8	8	8	25	35		28	35	
POTENTIAL SCORE	15	15	10	10	10	10			**0.71**			**0.80**
%	0.67	0.80	0.70	0.80	0.80	0.80						
C. Pesticides NOT RATED (NR)	NOT RATED		NOT RATED		NOT RATED		NOT RATED			NOT RATED		
NOTE: Includes herbicide. Contracted to licensed applicators, also Bio-control												
Audit team did not seen evidence of applications, owners indicated contracts.												
TOTALS FOR THE PAGE	39	41	37	36	61	61	137	195		138	195	
POTENTIAL PERFECT SCORE	60	60	50	50	85	85						
TOTAL SCORE/PERFECT SCORE	**0.65**	**0.68**	**0.74**	**0.72**	**0.72**	**0.72**		PAGE	**0.70**		PAGE	**0.71**
PROJECT TOTALS ALL THREE PAGES												
Totals per sale (accumulated)	197	198	251	250	256	257	704	935		707	935	
Total potential per sale	270	270	335	335	335	335						
SALE SCORE LINE	**0.73**	**0.73**	**0.75**	**0.75**	**0.76**	**0.77**		COMBINED	**0.75**		COMBINED	**0.76**

SD - Silviculture BMP Field Audit Data June 2001 PRIVATE TIMBERLANDS IN SD	WASP SALE INDUSTRIAL		PEARCO TREE FARMER		McKEE PRIVATE OWNER		COMBINED SCORES			COMBINED SCORES		
1.00 SCORE WENT BEYOND BMP REQUIREMENT AND IMPROVED RESOURCE NEEDS	Application	Effective	Application	Effective	Application	Effective	Application	Possible	Actual	Effective	Possible	Actual
.80 = MEETING REQUIREMENT-----.60 MINOR DEPARTURE FROM BMP's & RESOURCE NEEDS												
A. Roads- planning and Location												
1. Minimize number of rds in Watershed	4	4	4	4	4	4	12	15	0.80	12	15	0.80
2. Use consultant and pertinent information	0	0	3	3	4	4	7	10	0.70	7	10	0.70
3. Fit roads to topography	0	0	4	4	4	4	8	10	0.80	8	10	0.80
4. Locate on stable geology	0	0	4	3	3	4	7	10	0.70	7	10	0.70
5. Locate rds at safe distance from SMZ	0	0	4	3	4	4	8	10	0.80	7	10	0.70
6. Minimize number of SMZ crossings	0	0	4	4	4	4	8	10	0.80	8	10	0.80
7. Roads in relations to suitable log landings	0	0	4	4	4	4	8	10	0.80	8	10	0.80
SUBTOTAL	**4**	**4**	**27**	**25**	**27**	**28**	**58**	**75**		**57**	**75**	
POTENTIAL	5	5	35	35	35	35			**0.77**			**0.76**
%	0.80	0.80	0.77	0.71	0.77	0.80						
B. Road - Design												
1. Proper Drainage Facilities	0	0	3	3	4	4	7	10	0.70	7	10	0.70
2. Minimum standard for intended use	0	0	4	4	4	4	8	10	0.80	8	10	0.80
3. Use of balanced cut and fills	0	0	4	4	4	4	8	10	0.80	8	10	0.80
4.Minimum disturbance of drainage	0	0	3	3	4	4	7	10	0.70	7	10	0.47
5. CMP - SMZ - Adequate for fish passage/ 25yr. Impact event	3	2	4	4	3	2	10	15	0.67	8	15	0.53
SUBTOTAL	**3**	**2**	**18**	**18**	**19**	**18**	**40**	**55**		**38**	**55**	
POTENTIAL	5	5	25	25	25	25			**0.73**			**0.69**
%	0.60	0.40	0.72	0.72	0.76	0.72						
C. Road Surface Drainage												
1. Adequate drainage for all roads	4	3	3	4	4	4	11	15	0.73	11	15	0.73
1a. Outsloped	4	4	4	3	4	4	12	15	0.80	11	15	0.73
1b. Insloped	0	0	0	0	0	0	0	0		0	0	
1c. Drain dips	4	3	4	4	4	4	12	15	0.80	11	15	0.73
2. CMP installed at 20-30% Protect from plugging	0	0	0	0	0	0	0	0		0	0	
3. Install ditch relief /armor or anchor outlets	0	0	0	0	0	0	0	0		0	0	
4. Provide energy dissipaters where needed, all structures and cross drains	4	4	4	4	0	0	8	10	0.80	8	10	0.80
5. Prevent sediment movement downslope, catch basin, headwall,etc.	0	0	3	4	4	4	7	10	0.70	8	10	0.80
6. Install road drainage before SMZ or route through, use filter fields	4	4	4	4	4	4	12	15	0.80	12	15	0.80
SUBTOTAL	**20**	**18**	**22**	**23**	**20**	**20**	**62**	**80**		**61**	**80**	
POTENTIAL	25	25	30	30	25	25			**0.78**			**0.76**
%	0.80	0.72	0.73	0.77	0.80	0.80						
D. Road Construction												
1. Prudent and current use of erosion controls	4	4	3	4	4	4	11	15	0.73	12	15	0.80
2. Stabilize prior to fall/spring runoff periods	4	4	4	4	4	4	12	15	0.80	12	15	0.80
3. Use of slash/debris in low compact row at toe of potential erodible fill	4	4	4	4	3	4	11	15	0.73	12	15	0.80
4. Minimize use of Equipt. during periods soils are excessively wet	0	0	4	4	4	4	8	10	0.80	8	10	0.80
5.Cut/fills at stable angle of repose	0	0	3	2	3	3	6	10	0.60	5	10	0.50
6. Avoid incorporating unstable woody matter in fills	0	0	4	4	4	4	8	10	0.80	8	10	0.80
7. Surfacing provided to minimize erosion or (considered)	4	4	4	4	4	4	12	15	0.80	12	15	0.80
8. Overburden/other waste located away from SMZ and stabilization used	4	4	4	4	4	4	12	15	0.80	12	15	0.80
9. Precautions to reduce sediment from barrow/gravel pits	0	0	0	0	0	0	0	0		0	0	
10. Existing road use-provide erosion measures/ leave stable surfaces	2	3	4	4	4	4	10	15	0.67	11	15	0.73
SUBTOTAL	**22**	**23**	**34**	**34**	**34**	**35**	**90**	**120**		**92**	**120**	
POTENTIAL	30	30	45	45	45	45			**0.75**			**0.77**
%	0.73	0.77	0.76	0.76	0.76	0.78						
E. Road maintenance												
1. Use minimum maintenance necessary	4	4	4	4	4	4	12	15	0.80	12	15	0.80
2. Maintain all erosion features	2	1	4	4	4	4	10	15	0.67	9	15	0.60
3. Avoid uncutting cut slopes	4	4	4	4	3	3	11	15	0.73	11	15	0.73
4. Provide drainage breaks in all snow berms throughout winter periods	0	0	4	4	0	0	4	5	0.80	4	5	0.80
5. Avoid sidecast into SMZ, excessive waste in safe areas and stabilized	0	0	0	0	0	0	0	0		0	0	
6. Avoid road use during wet periods when damage to drainages likely	4	4	3	3	4	4	11	15	0.73	11	15	0.73
7. Practice seasonal maint. Clean and check all drains, to protect surfaces	4	4	3	3	4	4	11	15	0.73	11	15	0.73
8. Abandon roads, close off, provide proper erosion controls/recontour	0	0	0	0	0	0	0	0		0	0	
SUBTOTAL	**18**	**17**	**22**	**22**	**19**	**19**	**59**	**80**		**58**	**80**	
POTENTIAL	25	25	30	30	25	25			**0.74**			**0.73**
%	0.72	0.68	0.73	0.73	0.76	0.76						
TOTALS FOR PAGE	67	64	123	122	119	120	309	410		306	410	
POTENTIAL PERFECT SCORE	90	90	165	165	155	155						
TOTAL SCORE/PERFECT SCORE	**0.74**	**0.71**	**0.75**	**0.74**	**0.77**	**0.77**			**0.75**			**0.75**

SD - Silviculture BMP Field Audit Data June 2001 PRIVATE TIMBERLANDS IN SD	WASP SALE INDUSTRIAL		PEARCO TREE FARM		McKEE PRIVATE OWNER		COMBINED SCORES			COMBINED SCORES		
1.00 SCORE WENT BEYOND BMP REQUIREMENT AND IMPROVED RESOURCE NEEDS .80 = MEETING BMP REQUIREMENT-.60 MINOR DEPARTURE FROM BMP & RESOURCE NEEDS	Application	Effective	Application	Effective	Application	Effective	Application	Possible	Actual	Effective	Possible	Actual
A. Timber Harvest, (Harvest, SMZ,Site Prep.)												
1. Timber harvest planning and objects, water quality, land owner's	4	4	4	4	4	5	12	15	0.80	13	15	0.87
2. Select proper logging equip. for soil/topography	4	4	4	4	4	4	12	15	0.80	12	15	0.80
3. Select yarding system to minimize road densities	4	4	4	4	4	4	12	15	0.80	12	15	0.80
4. Use of log forwarding equipment	0	0	0	0	0	0	0	0		0	0	
5. Design and locate skid trails to minimize erosion	4	4	4	4	4	4	12	15	0.80	12	15	0.80
6. Locate skid trails, avoid concentration of runoff, limit grade, waterbar	4	4	4	4	4	4	12	15	0.80	12	15	0.80
7. Size and number of landings minimized, avoid skids across SMZ	3	3	3	3	4	5	10	15	0.67	11	15	0.73
SUBTOTALS	23	23	23	23	24	26	70	90		72	90	
POTENTIAL SCORE	30	30	30	30	30	30			**0.78**			**0.80**
%	0.77	0.77	0.77	0.77	0.80	0.87						
B. Streamside Management (SMZ)												
1. Designate SMZ to provide for its protection, 50 ft. both side of live stream	3	3	2	3	4	4	9	10	0.90	10	10	1.00
2a. Retainage of hardwoods, seed trees, shrubs, etc.	4	4	4	4	0	0	8	10	0.80	8	10	0.80
b. Protect stream banks, save future larger woody material	4	4	4	4	0	0	8	10	0.80	8	10	0.80
c. Restrict clearcutting along SMZ (< 600 ft.)	4	4	0	0	0	0	4	5	0.80	4	5	0.80
d. Recognize soil/drainage potential that can raise water table	0	0	0	0	0	0	0	0		0	0	
e. Provide for ground cover as sediment traps/whole tree or tree length	4	4	4	4	0	0	8	10	0.80	8	10	0.80
f. Protection given to steep slopes, rolling material into SMZ	0	0	0	0	0	0	0	0		0	0	
g. Slash free zones to maximumize streamside veg.if burning to be used	0	0	0	0	0	0	0	0		0	0	
h. Hand treatment of slash/slash left above high water mark	4	4	0	0	0	0	4	5	0.80	4	5	0.80
I. Landings in SMZ, prevent debris/sediment from entering stream	3	4	4	4	0	0	7	10	0.70	8	10	0.80
3. Minimumize use of equip. within the SMZ	3	3	3	3	4	4	10	15	0.67	10	15	0.67
4. Directional felling in SMZ/wet lands, avoid felling to streams or slash in	3	4	4	4	4	4	11	15	0.73	12	15	0.80
5. Suspend lead end of log, end-line out of SMZ	4	4	4	4	0	0	8	10	0.80	8	10	0.80
6 Avoid decking within high water- marks or any stream	4	4	4	4	4	4	12	15	0.80	12	15	0.80
SUBTOTALS	40	42	33	34	16	16	89	115		92	115	
POTENTIAL SCORE	55	55	45	45	20	20			**0.77**			**0.80**
%	0.73	0.76	0.73	0.76	0.80	0.80						
C. Other Harvest Activities												
1. Minimize damage to soils when skidding, avoid highly erodible soils	4	4	3	3	4	4	11	15	0.73	11	15	0.73
2. Provide and maintain drainage on all trails	4	4	4	4	4	4	12	15	0.80	12	15	0.80
3. Install required function water-bars with appropriate placement/distance	4	4	4	4	4	4	12	15	0.80	12	15	0.80
4. Seed/slash in all disturbed areas that lack adequate veg. Cover	4	4	4	4	4	4	12	15	0.80	12	15	0.80
SUBTOTALS	16	16	15	15	16	16	47	60		47	60	
POTENTIAL SCORE	20	20	20	20	20	20			**0.78**			**0.78**
%	0.80	0.80	0.75	0.75	0.80	0.80						
D. Slash Treatment/Site Preparations												
1.Plan for rapid reforestation	0	0	4	4	0	0	4	5	0.80	4	5	0.80
2. Abide by SD Codified Slash Regulations 21-10-26,27 and ARSD 12:02	4	4	4	4	4	4	12	15	0.80	12	15	0.80
3. Provide top soil protection by use of brush blades/piling	0	0	0	0	4	4	4	5	0.80	4	5	0.80
4. Minimize up/down slope scarification	0	0	0	0	0	0	0	0		0	0	
5. Minimize soil scarification for regen. Leave scattered slash for protect.	0	0	0	0	0	0	0	0		0	0	
6. Brush piling (Dry or Frozen) soils	0	0	4	4	4	4	8	10	0.80	8	10	0.80
7. Use of proper techniques to minimize erosion during scarification	0	0	0	0	0	0	0	0		0	0	
8. Reclaim/stabilize landings/temporary roads	4	4	4	4	4	4	12	15	0.80	12	15	0.80
9. Remove all machinery debris/ dispose of properly off site	4	4	4	4	4	4	12	15	0.80	12	15	0.80
10. Limit water quality impacts of prescribed fire w/use of erosion measures	0	0	0	0	0	0	0	0		0	0	
SUBTOTALS	12	12	20	20	20	20	52	65		52	65	
POTENTIAL SCORE	15	15	25	25	25	25			**0.80**			**0.80**
%	0.80	0.80	0.80	0.80	0.80	0.80						
TOTALS FOR PAGE	91	93	91	92	76	78	258	330		263	330	
POTENTIAL PERFECT SCORE	120	120	120	120	95	95						
TOTAL SCORE/PERFECT SCORE	**0.76**	**0.78**	**0.76**	**0.77**	**0.80**	**0.82**			**0.78**			**0.80**

SD - Silviculture BMP Field Audit Data June 2001 1.00 SCORE WENT BEYOND BMP REQUIREMENTS AND IMPROVES RESOURCE .80 = MEETING REQUIREMENTS OF BMP's .60 MINOR DEPARTURES FROM BMP"S & RESOURCE NEEDS	CRAWFORD T. S. USFS		GREENANT T.S. USFS		LAME JOHNNY SD STATE PARK		AGENCY TIMBER SALES COMBINED SCORES			AGENCY TIMBER SALES COMBINED SCORES		
	Application	Effective	Application	Effective	Application	Effective	Application	Possible	Actual	Effective	Possible	Actual
A. Stream Crossings - Legal Requirements dealing with pollution of streams												
DENR. SDCL 34A-2-33, AND 34,34A-2-11, AND 34A-2-93 SURFACE WATERS SD	4	4	3	4	3	4	10	15	0.67	12	15	0.80
B. Design Considerations for Roads/Cross drainage facilities												
1. Stream crossings designed at 90 deg. To main channel	0	0	4	4	4	5	8	10	0.80	9	10	0.90
2. Avoid unimproved stream crossings/drive through on stable areas	3	2	3	4	4	4	10	15	0.67	10	15	0.67
SUBTOTALS	7	6	10	12	11	13	28	40		31	40	
POTENTIAL SCORE	10	10	15	15	15	15			0.70			0.78
%	0.70	0.60	0.67	0.80	0.73	0.87						
C. Installations of stream crossings												
1. Minimize stream channel disturbance/sue of strawbales & silt fencing	0	0	0	0	2	3	2	5	0.40	3	5	0.60
2. Culvert installed correctly/fish may pass easily through	0	0	3	3	3	3	6	10	0.60	6	10	0.60
3. Culvert installed to prevent erosion of fill/compacted/armored	0	0	4	4	3	3	7	10	0.70	7	10	0.70
4. De-water (dammed/pumped/by-passed) at installation	0	0	0	0	3	3	3	5	0.60	3	5	0.60
5. Correct amount of fill over culvert (1 ft. for 18-36 in dia. Pipe)	0	0	4	4	4	4	8	10	0.80	8	10	0.80
6. Min. 15 inch culvert for permanent stream crossings/cross drains	0	0	4	5	4	4	8	10	0.80	9	10	0.90
SUBTOTALS	0	0	15	16	19	20	34	50		36	50	
POTENTIAL SCORE	0	0	20	20	30	30			0.68			0.72
%			0.75	0.80	0.63	0.67						
WINTER PERIOD LOGGING PERIODS												
A. General Directions												
1. Consider "snow-roads" on wet sites	4	4	4	4	4	4	12	15	0.80	12	15	0.80
2. Conduct operations when ground frozen or snow covered	4	5	4	4	4	4	12	15	0.80	13	15	0.87
3. Use experienced contractor with winter logging experience	4	4	4	4	4	4	12	15	0.80	12	15	0.80
SUBTOTALS	12	13	12	12	12	12	36	45		37	45	
POTENTIALSCORE	15	15	15	15	15	15			0.80			0.82
%	0.80	0.87	0.80	0.80	0.80	0.80						
B. Road Construction and Harvesting Considerations												
1. Hauling during frozen period/remove snow and allow ground to freeze	4	4	4	4	4	4	12	15	0.80	12	15	0.80
2. Mark culvert ends before deep snows	4	4	0	0	0	0	4	5	0.80	4	5	0.80
3. Compact snow for roadways in unroaded, wet or sensitive sites	4	4	0	0	0	0	4	5	0.80	4	5	0.80
4. Designate or mark stream courses prior to heavy deep snows	4	4	4	4	4	4	12	15	0.80	12	15	0.80
5. Prior to felling, use equipment to compact snow for skid trails	0	0	4	4	0	0	4	5	0.80	4	5	0.80
6. Follow prudent operations by returning early to complete erosion controls	4	4	0	0	4	4	8	10	0.80	8	10	0.80
7. Leave no slash in stream channels	4	4	4	4	4	4	12	15	0.80	12	15	0.80
SUBTOTALS	24	24	16	16	16	16	56	70		56	70	
POTENTIAL SCORE	30	30	20	20	20	20			0.80			0.80
%	0.80	0.80	0.80	0.80	0.80	0.80						
Hazardous Substances - Follow legal requirements												
A & B. General Direction												
1. Comply with storage/disposal of H.S. per regulations (licensing/applica)	4	4	4	4	0	0	8	10	0.80	8	10	0.80
2. Does not trans/store/load/dispose of in such a way as to pollute or harm.	4	4	3	4	4	4	11	15	0.73	12	15	0.80
3. Has written plan for H.S. spills and notification listing names and number	4	4	4	4	4	4	12	15	0.80	12	15	0.80
SUBTOTALS	12	12	11	12	8	8	31	40		32	40	
POTENTIAL SCORE	15	15	15	15	10	10			0.78			0.80
%	0.80	0.80	0.73	0.80	0.80	0.80						
C. Pesticides	NOT RATED		NOT RATED		NOT RATED			NOT RATED			NOT RATED	
NOT RATED (NR) Herbicides included. All contracted with licensed applicators. Team did not review practice												
TOTALS FOR THE PAGE	55	55	64	68	66	69	185	245		192	245	
POTENTIAL PERFECT SCORE	70	70	85	85	90	90						
TOTAL SCORE/PERFECT SCORE	**0.79**	**0.79**	**0.75**	**0.80**	**0.73**	**0.77**		PAGE	0.76		PAGE	0.78
PROJECT TOTALS AGENCY SALES (THREE PAGES)												
Totals per sale (accumulated)	212	216	293	304	222	227	727	977		747	977	
Total potential per sale	270	270	380	380	295	295						
SALE SCORE LINE	**0.79**	**0.80**	**0.77**	**0.80**	**0.75**	**0.77**		COMBINED	**0.74**		COMBINED	**0.76**

SD - Silviculture BMP Field Audit Data June 2001 FOREST SERVICE + SD PARK SALES 1.00 SCORE WENT BEYOND BMP REQUIREMENT AND IMPROVED RESOURCE NEEDS .80 = MEETING REQUIREMENT-----.60 MINOR DEPARTURE FROM BMP's & RESOURCE NEED	CRAWFORD T.S. USFS		GREENANT T.S. USFS		LAME JOHNNY SD STATE PARK		AGENCY TIMBER SALES COMBINED SCORES			COMBINED SCORES		
	Application	Effective	Application	Effective	Application	Effective	Application	Possible	Actual	Effective	Possible	Actual
A. Roads- planning and Location												
1. Minimize number of rds in Watershed	4	4	4	4	4	3	12	15	0.80	11	15	0.73
2. Use consultant and pertinent information	4	4	4	4	4	4	12	12	1.00	12	12	1.00
3. Fit roads to topography	0	0	4	4	3	3	7	10	0.70	7	10	0.70
4. Locate on stable geology	3	3	4	4	3	3	10	15	0.67	10	15	0.67
5. Locate rds at safe distance from SMZ	0	0	3	4	0	0	3	5	0.60	4	5	0.80
6. Minimize number of SMZ crossings	0	0	4	4	4	4	8	10	0.80	8	10	0.80
7. Roads in relations to suitable log landings	4	4	3	4	4	4	11	15	0.73	12	15	0.80
SUBTOTAL	**15**	**15**	**26**	**28**	**22**	**21**	**63**	**82**		**64**	**82**	
POTENTIAL	20	20	35	35	24	24			**0.77**			**0.78**
%	0.75	0.75	0.74	0.80	0.92	0.88						
B. Road - Design												
1. Proper Drainage Facilities	4	4	4	4	4	4	12	15	0.80	12	15	0.80
2. Minimum standard for intended use	4	4	4	4	4	4	12	15	0.80	12	15	0.80
3. Use of balanced cut and fills	4	4	4	4	0	0	8	10	0.80	8	10	0.80
4.Minimum disturbance of drainage	4	4	4	4	0	0	8	10	0.80	8	10	0.80
5. CMP - SMZ - Adequate for fish passage/ 25yr. Impact event	0	0	3	4	4	4	7	10	0.70	8	10	0.80
SUBTOTAL	**16**	**16**	**19**	**20**	**12**	**12**	**47**	**60**		**48**	**60**	
POTENTIAL	20	20	25	25	15	15			**0.78**			**0.80**
%	0.80	0.80	0.76	0.80	0.80	0.80						
C. Road Surface Drainage												
1. Adequate drainage for all roads	4	4	4	4	3	3	11	15	0.73	11	15	0.73
1a. Outsloped	0	0	0	0	0	0	0	0		0	0	
1b. Insloped	0	0	0	0	0	0	0	0		0	0	
1c. Drain dips	4	3	4	4	0	0	8	10	0.80	7	10	0.70
2. CMP installed at 20-30% Protect from plugging	0	0	0	0	0	0	0	0		0	0	
3. Install ditch relief /armor or anchor outlets	0	0	0	0	0	0	0	0		0	0	
4. Provide energy dissipaters where needed, all structures and cross drains	0	0	4	4	0	0	4	5	0.80	4	5	0.80
5. Prevent sediment movement downslope, catch basin, headwall,etc.	4	4	4	4	0	0	8	10	0.80	8	10	0.80
6. Install road drainage before SMZ or route through, use filter fields	0	0	4	4	0	0	4	5	0.80	4	5	0.80
SUBTOTAL	**12**	**11**	**20**	**20**	**3**	**3**	**35**	**45**		**34**	**45**	
POTENTIAL	15	15	25	25	5	5			**0.78**			**0.76**
%	0.80	0.73	0.80	0.80	0.60	0.60						
D. Road Construction												
1. Prudent and current use of erosion controls	4	4	4	4	4	4	12	15	0.80	12	15	0.80
2. Stabilize prior to fall/spring runoff periods	4	5	4	4	4	4	12	15	0.80	13	15	0.87
3. Use of slash/debris in low compact row at toe of potential erodible fill	3	3	4	4	0	0	7	10	0.70	7	10	0.70
4. Minimize use of Equipt. during periods soils are excessively wet	0	0	4	4	4	4	8	10	0.80	8	10	0.80
5.Cut/fills at stable angle of repose	4	4	4	4	0	0	8	10	0.80	8	10	0.80
6. Avoid incorporating unstable woody matter in fills	4	4	4	4	0	0	8	10	0.80	8	10	0.80
7. Surfacing provided to minimize erosion or (considered)	4	4	4	4	4	4	12	15	0.80	12	15	0.80
8. Overburden/other waste located away from SMZ and stabilization used	4	4	4	4	0	0	8	10	0.80	8	10	0.80
9. Precautions to reduce sediment from barrow/gravel pits	0	0	0	0	0	0	0	15	0.00	0	15	0.00
10. Existing road use-provide erosion measures/ leave stable surfaces	4	4	4	4	4	4	12	15	0.80	12	15	0.80
SUBTOTAL	**31**	**32**	**36**	**36**	**20**	**20**	**87**	**125**		**88**	**125**	
POTENTIAL	40	40	45	45	25	25			**0.70**			**0.70**
%	0.78	0.80	0.80	0.80	0.80	0.80						
E. Road maintenance												
1. Use minimum maintenance necessary	4	4	4	4	4	4	12	15	0.80	12	15	0.80
2. Maintain all erosion features	4	4	4	4	3	3	11	15	0.73	11	15	0.73
3. Avoid uncutting cut slopes	4	4	4	4	0	0	8	10	0.80	8	10	0.80
4. Provide drainage breaks in all snow berms throughout winter periods	4	4	4	4	0	0	8	10	0.80	8	10	0.80
5. Avoid sidecast into SMZ, excessive waste in safe areas and stabilized	0	0	0	0	0	0	0	15	0.00	0	15	0.00
6. Avoid road use during wet periods when damage to drainages likely	4	4	4	4	4	4	12	15	0.80	12	15	0.80
7. Practice seasonal maint. Clean and check all drains, to protect surfaces	4	4	4	4	3	3	11	15	0.73	11	15	0.73
8. Abandon roads, close off, provide proper erosion controls/recontour	4	3	4	4	0	0	8	10	0.80	7	10	0.70
SUBTOTAL	**28**	**27**	**28**	**28**	**14**	**14**	**70**	**105**		**69**	**105**	
POTENTIAL	35	35	35	35	20	20			**0.67**			**0.66**
%	0.80	0.77	0.80	0.80	0.70	0.70						
TOTALS FOR PAGE	102	101	129	132	71	70	302	417		303	417	
POTENTIAL PERFECT SCORE	130	130	165	165	95	95						
TOTAL SCORE/PERFECT SCORE	**0.78**	**0.78**	**0.78**	**0.80**	**0.75**	**0.74**			**0.72**			**0.73**

SD - Silviculture BMP Field Audit Data June 2001 1.00 SCORE WENT BEYOND BMP REQUIREMENT AND IMPROVED RESOURCE NEEDS .80 = MEETING BMP REQUIREMENT-.60 MINOR DEPARTURE FROM BMP & RESOURCE NEE	CRAWFORD T.S. USFS		GREENANT T.S. USFS		LAME JOHNNY SD STATE PARK		AGENCY TIMBER SALES COMBINED SCORES			AGENCY TIMBER SALES COMBINED SCORES		
	Application	Effective	Application	Effective	Application	Effective	Application	Possible	Actual	Effective	Possible	Actual
A. Timber Harvest, (Harvest, SMZ, Site Prep.)												
1. Timber harvest planning and objects, water quality, land owner's	4	5	4	5	4	4	12	15	0.80	14	15	0.93
2. Select proper logging equip. for soil/topography	4	4	4	5	4	4	12	15	0.80	13	15	0.87
3. Select yarding system to minimize road densities	4	4	4	4	4	4	12	15	0.80	12	15	0.80
4. Use of log forwarding equipment	0	0	0	0	0	0	0	0		0	0	
5. Design and locate skid trails to minimize erosion	4	5	4	4	4	4	12	15	0.80	13	15	0.87
6. Locate skid trails, avoid concentration of runoff, limit grade, waterbar	4	5	4	4	4	4	12	15	0.80	13	15	0.87
7. Size and number of landings minimized, avoid skids across SMZ	4	5	3	4	3	4	10	15	0.67	13	15	0.87
SUBTOTALS	24	28	23	26	23	24	70	90		78	90	
POTENTIAL SCORE	30	30	30	30	30	30			0.78			0.87
%	0.80	0.93	0.77	0.87	0.77	0.80						
B. Streamside Management (SMZ)												
1. Designate SMZ to provide for its protection, 50 ft. both side of live stream	0	0	3	4	3	4	6	10	0.60	8	10	0.80
2a. Retainage of hardwoods, seed trees, shrubs, etc.	0	0	4	4	4	4	8	10	0.80	8	10	0.80
b. Protect stream banks, save future larger woody material	0	0	4	4	0	0	4	5	0.80	4	5	0.80
c. Restrict clearcutting along SMZ (< 600 ft.)	0	0	0	0	0	0	0	0		0	0	
d. Recognize soil/drainage potential that can raise water table	0	0	0	0	0	0	0	0		0	0	
e. Provide for ground cover as sediment traps/whole tree or tree length	0	0	4	4	0	0	4	5	0.80	4	5	0.80
f. Protection given to steep slopes, rolling material into SMZ	0	0	3	3	0	0	3	5	0.60	3	5	0.60
g. Slash free zones to maximize streamside veg. if burning to be used	0	0	0	0	0	0	0	0		0	0	
h. Hand treatment of slash/slash left above high water mark	0	0	0	0	0	0	0	0		0	0	
I. Landings in SMZ, prevent debris/sediment from entering stream	0	0	3	3	4	4	7	10	0.70	7	10	0.70
3. Minimize use of equip. within the SMZ	0	0	4	4	4	4	8	10	0.80	8	10	0.80
4. Directional felling in SMZ/wet lands, avoid felling to streams or slash in	0	0	4	4	3	4	7	10	0.70	8	10	0.80
5. Suspend lead end of log, end-line out of SMZ	0	0	4	4	4	4	8	10	0.80	8	10	0.80
6 Avoid decking within high water- marks or any stream	0	0	4	4	4	4	8	10	0.80	8	10	0.80
SUBTOTALS	0	0	37	38	26	28	63	85		66	85	
POTENTIAL SCORE	0	0	50	50	35	35			0.74			0.78
%			0.74	0.76	0.74	0.80						
C. Other Harvest Activities												
1. Minimize damage to soils when skidding, avoid highly erodible soils	4	4	4	4	4	4	12	15	0.80	12	15	0.80
2. Provide and maintain drainage on all trails	4	4	4	4	4	4	12	15	0.80	12	15	0.80
3. Install required function water-bars with appropriate placement/distance	4	4	4	4	4	4	12	15	0.80	12	15	0.80
4. Seed/slash in all disturbed areas that lack adequate veg. Cover	4	4	4	4	4	4	12	15	0.80	12	15	0.80
SUBTOTALS	16	16	16	16	16	16	48	60		48	60	
POTENTIAL SCORE	20	20	20	20	20	20			0.80			0.80
%	0.80	0.80	0.80	0.80	0.80	0.80						
D. Slash Treatment/Site Preparations												
1.Plan for rapid reforestation	4	4	4	4	0	0	8	10	0.80	8	10	0.80
2. Abide by SD Codified Slash Regulations 21-10-26,27 and ARSD 12:02	3	4	4	4	4	4	11	15	0.73	12	15	0.80
3. Provide top soil protection by use of brush blades/piling	0	0	4	4	4	4	8	15	0.53	8	15	0.53
4. Minimize up/down slope scarification	0	0	0	0	0	0	0	0		0	0	
5. Minimize soil scarification for regen. Leave scattered slash for protect.	0	0	0	0	0	0	0	0		0	0	
6. Brush piling (Dry or Frozen) soils	0	0	4	4	4	4	8	10	0.80	8	10	0.80
7. Use of proper techniques to minimize erosion during scarification	0	0	0	0	0	0	0	0		0	0	
8. Reclaim/stabilize landings/temporary roads	4	4	4	4	4	4	12	15	0.80	12	15	0.80
9. Remove all machinery debris/ dispose of properly off site	4	4	4	4	4	4	12	15	0.80	12	15	0.80
10. Limit water quality impacts of prescribed fire w/use of erosion measures	0	0	0	0	0	0	0	0		0	0	
SUBTOTALS	15	16	24	24	20	20	59	80		60	80	
POTENTIAL SCORE	20	20	30	30	25	25			0.74			0.75
%	0.75	0.80	0.80	0.80	0.80	0.80						
TOTALS FOR PAGE	55	60	100	104	85	88	240	315		252	315	
POTENTIAL PERFECT SCORE	70	70	130	130	110	110						
TOTAL SCORE/PERFECT SCORE	**0.79**	**0.86**	**0.77**	**0.80**	**0.77**	**0.80**			**0.76**			**0.80**

APPENDIX C
SD BMP Audit Rating Guide

SOUTH DAKOTA RATING GUIDE
4/20/01

SALE NAME: _____
OWNERSHIP: _____
DATE: _____

NR – Not Reviewed NA – Not Applicable Y-Yes N-No

Application
5 – Operation exceeds requirements of BMP
4 – Operation meets requirements of BMP
3 – Minor Departure from BMP
2 – Major Departure from BMP
1 – Gross Neglect of BMP

Effectiveness
5 – Improved protection of soil and water resources over pre-project condition.
4 – Adequate protection of soil and water resources.
3 – Minor and temporary impacts on soil and water resources.
2 – Major and temporary or minor and prolonged impacts on soil and water resources.
1 – Major and prolonged impacts on soil and water resources.

Adequate – Small amount of material eroded; material does not reach draws, channels or floodplain.
Minor – Erosion and delivery of material to draws but not stream.
Major – Erosion and subsequent delivery of sediment to stream or annual floodplain.
Temporary – Impacts lasting one year or less; no more than one runoff season.
Prolonged – Impacts lasting more than one year.

REPORTING BY:_____

Application

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Effectiveness

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4 – Adequate protection of soil and water resources.
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	Application to site Y/N	Appli cation	Effectiveness	Comments
Roads				
A. Planning and Location				
1. Minimize the number of roads constructed in a watershed through comprehensive road planning, recognizing intermingled ownership and foreseeable future uses. Use existing roads where practical, unless use of such roads would cause or aggravate an erosion problem.				
2. Review available information and consult with professionals as necessary to help identify erodible soils and unstable areas, and to locate appropriate road surface materials.				
3. Fit the road to the topography by locating roads on natural benches and following natural contours. Avoid long, steep road grades and narrow canyons.				
4. Locate roads on stable geology, including well-drained soils and rock formations that tend to dip into the slope. Avoid slumps and slide-prone areas characterized by steep slopes, highly weathered bedrock, clay beds, concave slopes, hummocky topography, and rock layers that dip parallel to the slope. Avoid wet areas, including moisture-laden or unstable toe slopes, swamps, wet meadows, wetlands, and natural drainage channels.				

Application

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	Application to site Y/N	Appli cation	Effectiveness	Comments
5.Locate roads a safe distance from streams when roads are running parallel to stream channels. Provide an adequate streamside management zone (SMZ) or other appropriate management technique to trap sediment and prevent its entry into the stream.				
6. Minimize the number of stream crossings and choose stable stream crossing sites.				
7. Locate roads to provide access to suitable (relatively flat and well-drained) log landing areas to reduce soil disturbance. Landings and roads should be located a safe distance from streams. Sediment traps should be utilized where needed.				
B. Design				
1. Properly design roads and drainage facilities to prevent potential water quality problems from road construction.				
2. Design roads to the minimum standard necessary to accommodate anticipated use and equipment. The need for higher standard roads can be alleviated through better road-use management.				
3. Design roads to balance cuts and fills or use side cast or end haul where stable fill construction is not possible.				
4. Design roads for minimal disruption of drainage patterns. Vary road grades to reduce concentrated flow in road drainage ditches, culverts, and on fill slopes and road surfaces.				
5. Design stream-crossings for adequate passage of fish if present, minimum impact on water quality, and at-a-minimum, a 25-year frequency runoff (see Section IV for other stream-crossing BMP's).				

Application

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2 – Major Departure from BMP
1 -- Gross neglect of BMP

Effectiveness

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1 – Major and prolonged impacts on soil and water resources.

	Application to site Y/N	Appli cation	Effectiveness	Comments
C. Drainage from Road Surface				
1. Provide adequate drainage from the surface of all permanent and temporary roads. Recommended techniques include but are not limited to using outsloped or crowned roads, drain dips, or insloped roads with ditches and crossdrains. Space road drainage features so peak drainage flow on the road surface or in ditches will not exceed the capacity of the individual drainage facilities.				
a. Outsloped roads provide means of dispersing water in all low-energy flow from the road surface. Outsloped roads are appropriate when fill slopes are stable, drainage will not flow directly into stream channels, and transportation safety considerations can be met.				
b. For insloped roads, plan ditch gradients steep enough, generally greater than 2%, but less than 8%, to prevent sediment deposition and ditch erosion. The higher gradients may be suitable for more stable soils; use the lower gradients for less stable soils/				
c. Properly constructed drain dips can be economical method of channeling surface flow off the road. Construct drain dips deep enough into the subgrade so that traffic will not obliterate them.				
2. Skew ditch relief culverts approximately 20 to 30 degrees toward the inflow from the ditch to improve inlet efficiency. Protect the upstream end of cross-drain culverts from plugging.				

Application

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Effectiveness

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	Application to site Y/N	Appli cation	Effectiveness	Comments
3. Where possible, install ditch relief culverts at the gradient of the original ground slope; otherwise armor outlets with rock or anchor downspouts to carry water safely across the fill slope.				
4. Provide energy dissipaters (rock piles, logs, etc.) where necessary at the downstream end of ditch relief culverts to reduce the erosive energy of the emerging water. Crossdrains, culverts, water bars, dips, and other drainage structures should not discharge onto erodible soils or fill slopes without outfall protection.				
5. Prevent downslope movement of sediment by using sediment catch basins, drop inlets, changes in road grade, headwalls, or recessed cut slopes.				
6. Route road drainage through the SMZ, filtration fields, or other sediment settling structures. Install road drainage features above stream crossings to route discharge into filtration zones before entering a stream.				
D. Construction *(See also Section IV on stream crossings)*				
1. Keep slope stabilization, erosion and sediment control work as current as possible with road construction. This includes installing drainage features as part of the construction. Complete or stabilize road sections within the same operating season, ensuring that drainage features are fully functional prior to spring or fall runoff and that major road sections are not left in an unstable condition over winter.				

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2. Stabilize erodible, exposed soils by seeding, compacting, riprapping, benching, mulching, or other suitable means prior to fall or spring runoff.				
3. At the toe of potentially erodible fill slopes, particularly near stream channels, pile slash in a row parallel to the road to trap sediment. When done concurrently with road construction, this practice can effectively control sediment movement and can provide an economical way of disposing of roadway slash. Limit the height, width, and length of these "slash filter windrows" in way that will not impede wildlife movement.				
4. Minimize earth-moving activities when soils appear excessively wet. Do not disturb roadside vegetation more than necessary to maintain slope stability and to serve traffic needs.				
5. Construct cut and fill slopes at stable angles.				
6. Avoid incorporating potentially unstable woody debris in the fill portion of the road prism. Where possible, leave existing rooted trees or shrubs at the toe of the till slope to stabilize the fill.				
7. Consider road surfacing to minimize erosion.				
8. Place debris, overburden, and other waste materials associated with construction and maintenance activities in a location to avoid entry into streams. Include these waste areas in soil stabilization planning for the road.				
9. Minimize sediment production from borrow pits and gravel sources through proper location, development and reclamation.				

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10. When using existing roads, reconstruct only to the extent necessary to provide adequate drainage and safety; avoid disturbing stable road surfaces.				
E. **Maintenance**				
1. Grade road surfaces only as often as necessary to maintain a stable running surface and to retain the original surface drainage.				
2. Maintain erosion control features through periodic inspection and maintenance, including cleaning dips and crossdrains, repairing ditches, marking culvert inlets to aid in location, and clearing debris from culverts.				
3. Avoid cutting the toe of cut slopes when grading roads or pulling ditches.				
4. When plowing snow for winter timber harvests, provide breaks in snow berms to allow road drainage.				
5. Haul all excess material removed by maintenance operations to safe disposal sites and stabilize these sites to prevent erosion. Avoid sidecasting material into streams or locations where erosion will carry materials into streams.				
6. Avoid using roads during wet periods if such use would likely damage the road drainage features.				
7. Upon completion of seasonal operations, the road surface should be crowned, outsloped, insloped, or water-barred. Remove berms from the outside edge where runoff is channeled.				

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8. Leave abandoned roads in a condition that provides adequate drainage without further maintenance. Close these roads to traffic; reseed and/or scarify, and, if necessary , recontour and provide water bars or drain dips.				
TIMBER HARVESTING, STREAMSIDE MANAGEMENT, AND SITE PREPARATION				
A. Harvest				
1. Plan a timber harvest with consideration for the land owner's objectives and the potential effects on water quality and beneficial water uses.				
2. Use logging systems that fit the topography, soil type, and season, while minimizing soil disturbance to economically accomplish silvicultural objectives.				
3. Use a yarding system that is economical and minimizes road densities.				
4. Use log forwarding where it is economical and feasible to reduce road density and land impacts.				
5. Design and locate skid trails and skidding operations to minimize soil disturbance. Using designated skid trails is one means of limiting site disturbance and soil compaction. Consider the potential for erosion and possible alternative yarding systems prior to planning tractor skidding on steep or unstable slopes.				

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6. Locate skid trails to avoid concentrating runoff and provide breaks in grade. Locate skid trails and landings away from natural drainage systems and divert runoff to stable areas. Limit the grade of constructed skid trails on geologically unstable, saturated, highly erosive, or easily compacted soils to a maximum of 30 %. Use mitigating measures, such as water bars and grass seeding, to reduce erosion on skid trails.				
7. Minimize the size and number of landings to accommodate safe, economic operation. Avoid locating landings that require skidding across drainage bottoms.				

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B. Streamside Management				
1. Designate streamside management zones to provide stream shading, soil stabilization, sediment, and water filtering effects, and wildlife habitat. The SMZ encompasses a strip at least 50-feet wide on each side of a stream, measured from the ordinary high water mark or definable bank. The width of the SMZ should extend beyond the 50-foot minimum to include wetlands along a stream bottom and to provide additional protection in areas of steep slopes or erosive soils. Consult with forestry professionals, soil and water conservation specialists, or biologists if assistance is needed in setting appropriate SMZ boundaries.				
2. Consider the following practices when harvesting timber in streamside management zones:				
a. Retain hardwood trees, seed trees, sub-merchantable trees and shrubs adjacent to streams.				
b. Retain trees necessary for bank stabilization and as a future source of large woody debris to the stream channel. In the proper locations, large woody debris in the stream channel helps to dissipate stream energy, stabilize banks, and form pools that trap sediment and provide essential fish habitat.				
c. When clearcutting up to the stream edge, consider the length of stream channel opened to the sun. Where possible, keep continuous openings under 600 feet of stream length. This helps to prevent increases in water temperature and promotes wildlife habitat diversity,				

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d. Recognize that in some soil and drainage types, clearcutting can cause marked increases in the water table, cold-air ponding, and grass/shrub competition. All of these factors can inhibit conifer regeneration. Some mature trees may need to be left on these sites to ensure conifer reestablishment.				
e. Maintain or provide sufficient ground cover to trap sediment. Hand-scalping and planting may be preferable to machine scarification or burning within the SMZ. Whole-tree or tree-length yarding can reduce the need for slash disposal in the SMZ.				
f. Steep slopes containing material that may roll down-slope and fall into a stream during burning should receive special attention. Trees logged along streams may be high-stumped to help prevent this debris build up in streams. Other mechanical methods may be necessary to prevent debris entering the stream.				
g. A slash-free zone may be necessary to maintain streamside vegetation if site preparation will involve burning on steep ground adjacent to the SMZ.				
h. Hand treatment of slash and the retention of slash above the high water mark maybe necessary to trap sediment.				
i. Landings may be placed in the SMZ as a last resort. However, care must be taken to prevent debris and sediment from entering streams.				

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3. Minimize operation of wheeled or tracked equipment within the SMZ, and avoid equipment operation in wetlands, except when the ground is frozen. (see Section V on winter logging). Do not operate equipment on stream banks.				
4. Use directional falling for harvest operations in the SMZ or wetlands. Avoid falling trees or leaving slash in streams or water bodies. Limb or top trees above the high-water mark, and remove slash from stream and store above high water mark.				
5. Suspend the lead end of a log during skidding whenever possible, and use cables to end-line logs out of SMZ's and wetlands when ground skidding systems are employed.				
6. Avoid decking logs within the ordinary high-water mark of any stream.				
C. Other Harvesting Activities				
1. Tractor skid when compaction, displacement, and erosion will be minimized. Avoid tractor or wheeled skidding on unstable, permanently or seasonally wet, or easily compacted soils and on slopes that exceed 40% unless operation can be conducted without causing excessive erosion. Avoid skidding on highly erodible soils or with the blade lowered.				
2. For each landing , skid trail, or fire trail, provide and maintain a drainage system to control the dispersal of water and to prevent sediment from entering streams.				
3. Install necessary water bars on tractor skid trails; appropriate spacing between bars is determined by the soil type and slope of the skid trails. Timely implementation is important.				

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4. When natural revegetation is inadequate to prevent accelerated erosion before the next growing season, apply seed or construct water bars on skid trails, landings and fire trails. A light ground cover of slash or mulch will retard erosion.				
D. Slash Treatment and Site Preparation				
1. Rapid reforestation of harvested areas is encouraged to establish protective vegetation.				
2. Attention given to South Dakota Codified Laws 21-10-26 & 21-10-27 when dealing with treatment of logging slash and ARSD 12:12:02.				
3. Use brush blades on dozers when piling slash. Avoid use of dozers with angle blades. Site preparation equipment producing irregular surfaces is preferred. Care should be taken to preserve the surface soil horizon.				
4. Minimize or eliminate elongated exposure of soils up and down the slope during mechanical scarification.				
5. Scarify the soil only to the extent necessary to meet the reforestation objective of the site. Some slash and debris (preferably leaves, needles, or small limbs) should be left to slow surface runoff, return soil nutrients, and provide shade for seedlings.				
6. Carry out brush piling and scarification when soils are frozen or dry enough to minimize compaction and displacement.				

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7. Carry out scarification on steep slopes in a manner that minimizes erosion. Alternate methods of site preparation should be considered on slopes greater than 40 percent.				
8. Stabilize or reclaim landings and temporary roads on completion of use.				
9. Remove all logging machinery debris and deposit it at a proper disposal site.				
10. Limit water quality impacts of prescribed fire by constructing water bars in firelines; not placing slash in drainage channels; maintaining the streamside management zone; and avoiding intense fires unless needed to meet management goals.				
STREAM CROSSINGS				
A. **Legal Requirements** (*State Regulations*)				
Attention given to SDCL 34A-2-33, 34A-2-34, 34A-2-11, & 34A-2-93 when dealing with the possibility of pollution of surface waters. Rules have been promulgated by the Department of Environment and Natural Resources pursuant to the previous stated laws and are located in Appendix B.				
B. **Design Considerations**				
1. Design stream crossings at right angles to the main channel if practical. Adjust the road grade to reduce the concentration of water carried by drainage ditches to stream crossings. Direct drainage flows through a SMZ and away from the stream crossing site.				
2. Avoid unimproved stream crossings. When a culvert or bridge is not feasible, locate drive-troughs on a stable, rocky portion of a stream channel.				

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C. Installation of Stream Crossings				
1.Minimize stream channel disturbances and related sediment problems during road construction and installation of stream crossing structures. Use silt fencing, interlocking straw bales, or other methods to prevent soil and other debris from entering streams during construction until disturbed soil has been stabilized. It may be necessary to install silt fencing across channels downstream from construction to prevent migration of sediment. This basin will need to be cleaned out and removed after the construction site has stabilized. Do not place erodible material in stream channels. Remove stockpiled material from high water zones. Locate temporary construction bypass roads in locations where the stream course will have minimal disturbance. Time construction activities to protect fisheries and water quality.				
2. When using culverts to cross small streams, install those culverts to conform to the natural stream bed and slope on all perennial streams and on intermittent streams that support fish or that provide seasonal fish passage. Place culverts slightly below normal stream grade to avoid culvert outfall barriers. Do not alter stream channels upstream from culverts unless it is necessary to protect fill or to prevent culvert blockage.				

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3. Install culverts to prevent erosion of fill. Compact the fill material to prevent seepage and failure. Armor the inlet and/or outlet with rock or other suitable material where needed.				
4. Consider "dewatering" stream-crossing sites during culvert installation.				
5. Use 1-foot minimum cover for culverts 18 to 36 inches in diameter, and a cover of one-third for diameter larger culverts to prevent crushing by traffic.				
6. Use culverts with a minimum diameter of 15 inches for permanent stream crossings and cross drains.				
WINTER LOGGING				
A. General				
1. Consider "snow-road" construction and winter harvesting on sites characterized by wet meadows, high-water tables, sensitive riparian conditions or other potentially significant soil erosion and compaction hazards.				
2. Conduct winter logging operations when the ground is frozen or snow cover is adequate (generally more than one foot) to minimize site disturbance. Be prepared to suspend operations if conditions change rapidly and before the erosion hazard becomes high.				
3. Consult with operators experienced in winter logging techniques.				
B. Road Construction and Harvesting Considerations				

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1. For road systems across areas of poor foundation, consider hauling only during frozen periods. During cold weather, plow any snow cover off of the roadway to facilitate deep freezing of the road grade prior to hauling.				
2. Before logging, mark existing culvert locations. During and after logging, make sure that all culverts and ditches are open and functional.				
3. Use compacted snow for road beds in unroaded, wet or sensitive sites. Construct snow roads for single-entry harvests or for temporary roads.				
4. Designate or mark all stream courses, including small streams, prior to snowfall. Conduct activities in streamside zones so that ground disturbance is minimized. Following completion of snow road use, restore stream crossings to near pre-road conditions to prevent ice dams. Do not use the stream channel for the roadway except for crossings.				
5. Prior to felling in wet unfrozen soil areas, use tractors or skidders to compact the snow for skid road locations. Avoid steeper areas where frozen skid trails may be subject to erosion the next spring.				
6. Return the following summer and build erosion barriers on any trails that are steep enough to erode.				
7. Do not leave slash and tops in streams.				
HAZARDOUS SUBSTANCES				
A. Legal Requirements				
Attention given to SDCL 38-19 & ARSD 12;44 Fertilizer Rules; SDCL 38-20A, 38-21 & ARSD 12;56 Pesticides Rules.				

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B. General				
1. Know and comply with regulations governing the storage, handling, application (including licensing of applicators), and disposal of hazardous substances.				
2. Do not transport, handle store, load, apply or dispose of and hazardous substance in such a manner as to pollute water supplies or waterways, or cause damage or injury to land, human, desirable plant, or animals.				
3. Develop a contingency plan for hazardous substance spills, including cleanup procedures and notification of the Department of Environment & Natural Resources. Notification of the Department of Agriculture (SDDA) is required regarding spills of pesticides or fertilizers.				
C. Pesticides				
1. Use an integrated approach to weed and pest control, including manual, biological, mechanical, preventive and chemical means.				
2. Prevent the entry of hazardous substances into surface waters.				
3. To enhance effectiveness and prevent transport into streams, apply chemical during appropriate weather conditions (generally calm and dry) and during the optimum time for control of the target pest or weed.				

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NRCS Standards

326 Clearing and Snagging
338 Prescribed Burning
342 Critical Area Planting
349 Dam, Multiple Purpose
350 Sediment Basin
356 Dike
362 Diversion
378 Pond
393 Filter Strip
395 Fish Stream Improvement
410 Grade Stabilization Structure
423 Hillside Ditch
490 Woodland Site Preparation
460 Land Clearing
484 Mulching
490 Woodland Site Preparation
500 Obstruction Removal
560 Access Road
561 Heavy Use Area Protection
580 Streambank & Shoreline Protection
582 Open Channel
584 Stream Channel Stabilization
587 Water Control Structure
595 Pest Management
606 Subsurface Drain
608 Surface Drain Main or Lateral
650 Woodland Direct Seeding
652 Woodland Direct Seeding
666 Woodland Improvement
680 Nutrient Management

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