Monitoring of Forestry BMPs in Michigan
Fall 2014

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For the Michigan Sustainable Forestry Initiative Implementation Committee

December, 2014

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The Michigan Forest Products Council (MFPC) provides general management functions and services for operations of the Michigan SFI IC. The MFPC is a trade association representing the state's forest products industry which includes landowners, foresters, sawmills and manufacturers of cabinets, furniture, flooring, pulp, paper, paperboard, lumber, panel board, plywood, oriented strand board, utility poles veneer, and many other wood products. For more information regarding the MFPC or Michigan forest products companies, go to: http://www.michiganforest.com/

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Table of Contents

Page

Executive Summary 3

Introduction

- What Are BMPs? 4
- Michigan's Forestry BMPs 4
- The 2014 BMP Audit Process 6

Audit Results

- Introduction 10
- Statewide Results 10
- Other Observations & Comparisons
  - Differences by Michigan Region 23
  - Differences by Ownership Category 24
  - Comparisons with Other Past Michigan Audits 25
  - Comparisons with Other States' BMP Audits 27
  - Primary Issues for Future Audits 28

Summary and Conclusions 31

References 33

Appendices

- A. SFI IC BMP Audit Proposal and April 2, 2014 Conference Call Notes 35
- B. Field Worksheet (includes list of BMP audit items and rating guide) 40
- C. Site Selection Spreadsheet 48
- D. Michigan SFI IC Participants and Partners, December 2014 49
- E. 2014 Audit Team Members 50
- F. Responses to Audit Field Worksheet Supplemental Questions 51

Executive Summary

Fall, 2011 statewide BMP audits of twenty-nine logging sites indicated overall compliance with Michigan's Best Management Practices (BMPs) had improved significantly during the previous two decades. The audit results were consistent with people's perceptions of improvement in public and private forestry operations since audits had been conducted in 1996 and 1997. Individual forest product firm monitoring also affirmed the performance improvements. Now, recently completed 2014 BMP audits on thirty-six recently harvested timber sites in northern Michigan indicate that a high level of BMP compliance has been maintained.

The audit process was designed and coordinated by a BMP subcommittee of the Michigan SFI Implementation Committee (SFI IC). Candidate sites were nominated by SFI IC Participants and the U.S. Forest Service. The audit teams consisted of public and private forestry experts and Michigan DEQ staff. Implementations of seventy-seven different BMPs were considered for each site along with seven supplemental questions and an overall water quality impact rating. The BMPs cover equipment operation and maintenance, road systems, stream crossings, skidding, landings, riparian management zones, wetlands, and other dimensions and possible impacts of timber harvesting.

Overall, where BMPs were deemed needed, 89% were rated as "applied correctly" and another 5% were rated as having an "acceptable variation." These estimates are very comparable to, but slightly lower than, the 93% and 6% rates found in 2011. In contrast, overall compliance results were 75% in 1996 and 82% in 1997. Sustainable forestry certification standards and practices implemented since the earlier audits are likely the most important factors behind this improvement. The continued high level of compliance provides evidence that Forestry BMPs and their statewide implementation in Michigan is successful and the goals of soil and water quality protection are being met. Continued investment in BMP education and auditing is necessary to maintain this success and strengthen these results.

Fall 2014 BMP Results by Category

	---------- BMP Needed ----------				
Category	applied correctly	acceptable variation	applied incorrectly	not applied	Total of BMP Needed
1 Equipment Operation and Maintenance	97.1%	0.0%	0.0%	2.9%	100.0%
2 Roads *(& road retirement)*	85.63%	3.44%	7.81%	3.13%	100.00%
3 Stream Crossings	82.74%	5.36%	7.74%	4.17%	100.00%
4 Skidding & Skid Trails	82.14%	7.14%	1.43%	9.29%	100.00%
5 Landings	94.23%	5.77%	0.00%	0.00%	100.00%
6 Riparian Management Zones	91.52%	6.97%	1.21%	0.30%	100.00%
7 Wetlands	92.00%	0.00%	4.00%	4.00%	100.00%
8 Other Considerations	95.35%	4.65%	0.00%	0.00%	100.00%
Overall	88.56%	5.12%	3.60%	2.72%	100.00%

Introduction

What are BMPs?

The term 'Best Management Practices', or BMPs, was coined years ago as a way to describe acceptable practices that could be implemented to protect water quality and promote soil conservation during forestry activities. BMPs are often combinations of practices that have been determined to be effective and practicable (with respect to technological, economic, and institutional considerations) in preventing or reducing the amount of nonpoint pollution to a level compatible with water quality goals. A BMP can be a structural "thing" that you actually install on-the-ground. Examples of these include runoff diversions, silt fence, stream buffers and ground cover vegetation over bare soil areas. A BMP can also be part of the "process" that you use to plan, conduct and close-out your forestry operation. Examples of these include pre-harvest planning, laying out roads in advance of construction, marking stream buffers with paint or flagging, and locating streams on the site before you begin work.

Nonpoint source pollution is a term to describe undesirable runoff that flows across the ground surface. The U.S. Environmental Protection Agency defines the term this way (cited from National Management Measures to Control Nonpoint Source Pollution from Forestry, April 2005):

> Nonpoint source pollution usually results from precipitation, atmospheric deposition, land runoff, infiltration, drainage, seepage or hydrologic modification. As runoff from rainfall or snowmelt moves, it picks up and carries natural pollutants and pollutants resulting from human activity, ultimately dumping them into rivers, lakes, wetlands, coastal waters and groundwater. Technically, the term nonpoint source is defined to mean any source of water pollution that does not meet the legal definition of point source in section 502(14) of the Clean Water Act of 1987. Nonpoint sources include return flow from irrigated agriculture, or other agriculture runoff and infiltration; urban runoff from small or non-sewered urban areas; flow from abandoned mines; hydrologic modification; and runoff from forestry activities.

By effectively using BMPs, you have a very high likelihood of preventing and controlling polluted runoff, before it can reach a stream, pond, or wetland. And if you prevent or control nonpoint source pollution, you will most likely stay in compliance with the various water quality regulations for Michigan.

Michigan's Forestry BMPs

For forestry activities in Michigan, best management practices are defined by the publication "Sustainable Soil and Water Quality Practices on Forest land" developed by the Michigan Department of Natural Resources (MI DNR) and Michigan Department of Environmental Quality. The publication is also commonly referred to as the Soil and Water Quality Manual or Michigan's BMP Manual. The Manual describes a set of voluntary Forestry Best Management Practices (BMPs) which protect our soil and water resources while allowing appropriate use of our forest resources. The current 2009 version is an update of the 1994 publication, Water Quality Practices on Forest Land. BMPs described in previous editions are incorporated into the 2009 manual and their

specifications have not changed much, nor have the statutes governing them. However, the scope and use of the term "Best Management Practices" has expanded. The manual describes BMPs in the context of those practices that not only protect surface water quality, but soil quality too. All Michigan forest landowners, managers and loggers are strongly encouraged to implement BMPs whenever forestry activities are conducted. The BMP manual may be found online through the MI DNR at: http://www.mi.gov/documents/dnr/IC4011_SustainableSoilAndWaterQualityPracticesOnForestLand_268417_7.pdf

The full set of Michigan forestry BMPs are voluntary guidelines and most are not required by law, although some are such as ones applying to wetlands and fuel spills. (The applicable laws and legal dimensions of BMPs are clearly delineated within the BMP Manual.) However, market-demand driven forest certification programs have developed and maintained the awareness and implementation of forestry BMPs to an increased level of importance. SFI certification requires that participants meet or exceed the recommended BMPs for each state in which they own timberland, harvest timber or purchase timber for manufacturing operations. Part of this requirement is monitoring to assess the degree to which BMPs are used in Michigan. The Michigan SFI IC in conjunction with the Michigan DNR and DEQ will periodically conduct statewide implementation surveys such as the Fall 2014 audit to achieve this goal.

SFI has generated strong support for BMP auditing. The third objective under the 2010-2014 Standard of SFI is protection and maintenance of water resources. Indicators of this objective include:

- Programs to implement state or provincial best management practices during all phases of management activities.
- Monitoring of overall best management practices implementation.

Most major Michigan wood products companies and large corporate landowners are certified under SFI and have been conducting ongoing or annual internal BMP audits. Several of these firms have been recognized for their water quality protective and enhancement practices during their third party SFI forest certification audits. As evidence of their intent to maintain and support a high standard of BMP practices, some companies have even stopped purchasing wood fiber from firms who have not lived up to BMP standards.

The 2014 BMP Audit Process

Over the summer of 2014, a subcommittee of the Michigan Sustainable Forestry Initiative Implementation Committee (SFI IC) developed a plan and procedures for conducting BMP audits (see Appendix A). The plan was largely built around updating and using a process similar to the one established for the 2011 audit, including a Forest and Soil Water Quality Review Field Worksheet (see Appendix B). This worksheet was based on and tied to recommended practices from the 2009 Michigan DNR/DEQ BMP Manual guidelines.

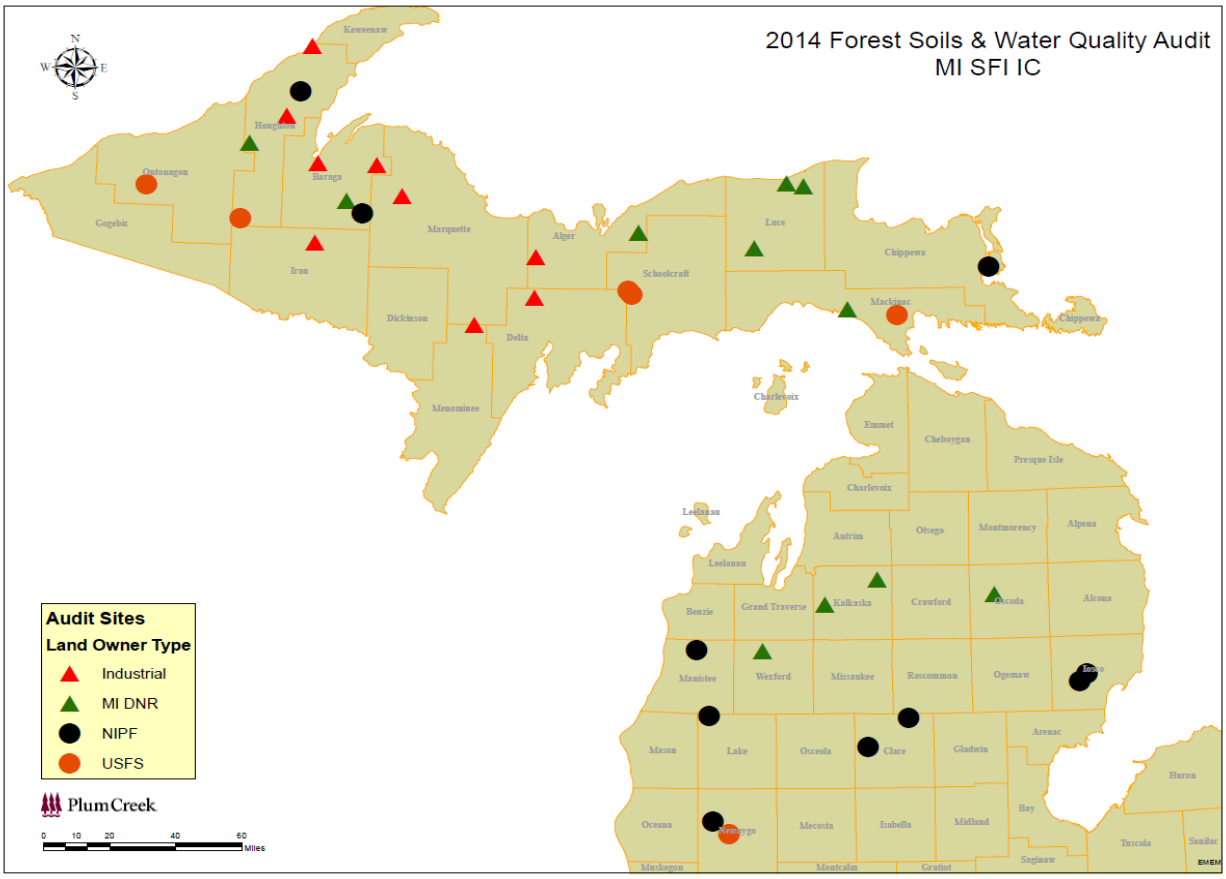
Candidate audit sites were solicited by the BMP subcommittee from SFI IC participant companies, the DNR, and the U.S. Forest Service. More than 140 sites in total were submitted. Criteria used for site selection included (see Appendix C):

1. Timber sales harvested (and completed or nearly complete) between May, 2013 and September, 2014
2. A body of water is located in or very near the sale
3. Minimum sale size of 5 acres
4. Site located no more than one-half mile from a road or trail accessible with a two wheel drive vehicle.
5. Sale with unlevel or steep terrain, wetlands, riparian zones, road construction, and other types of buffer zones are preferred (see BMP audit site selection worksheet for more detail).
6. Location related to other sites

The state was divided into 3 regions for teams to select candidate timber sales audit sites. Lead auditors were appointed by the subcommittee chair for the Western Upper Peninsula (WUP), Eastern Upper Peninsula (EUP), and the Northern Lower Peninsula (NLP). Audit team members were selected from forest industry, the U.S. Forest Service, the MI DNR forest resources division and MI DEQ (see Appendix E). Approximately half the audit team members had participated in the 2011 audits. Lead auditors collectively evaluated the submitted candidate sites and selected 12 for each region based on site characteristics and logistics. Sites with the greatest potential impact to water quality were selected based upon a system of risk rating and the six criteria listed above (see Site Selection Spreadsheet, Appendix C). As the Audit Sites map on the next page indicates, consideration was also given to distributing the sites. Overall, the sites were better distributed throughout the three northern Michigan regions than they were in 2011, in part because there were seven more sites audited in 2014.

Plans were developed to conduct the audits in 4-day time periods. A two-hour training session was held for audit team members to review forms and discuss audit protocols. Participants on the audit teams individually appraised the audit sites and the audit team developed a consensus audit report for each site. The audits were conducted in

September and October of 2014. Following the audits, each audit participant was mailed a copy of their individual site results along with a letter of thanks.



by Ed Meddaugh, Plum Creek Analyst & Kate Miller, Plum Creek Intern

Sites were rated on eight areas of focus (categories) based upon the BMP Manual, including:

- Equipment Operations and Maintenance
- Roads (including road closure and retirement which was split out in 2014, but not in 2011; it is combined throughout this report for ease of comparisons with 2011)
- Stream Crossings
- Skidding and Skid Trails
- Landings
- Riparian Management Zones
- Wetlands
- Other Considerations such as threatened and endangered (T&E) species, archeological sites, and regeneration.

Within these eight categories, there were seventy-seven individual BMP practices coded according to the rating system followed in 2011:

- BMP needed, applied correctly
- BMP needed, acceptable variation
- BMP needed, applied incorrectly
- BMP needed, not applied
- BMP not applicable
- Insufficient information to rate

The audit team discussing the needs of a skid road for stabilization and closure.

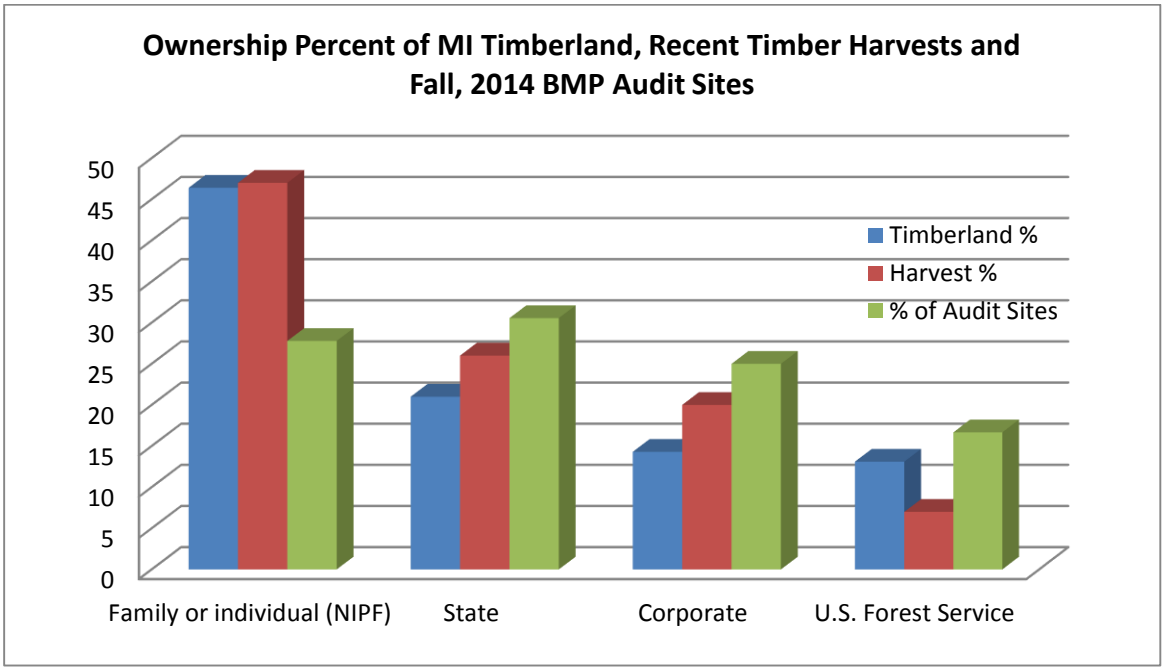
The meanings of most of these codings are straightforward. “Acceptable variation” is where a practice is different than what is presented in the BMP Manual, but the outcome was acceptable and in the spirit of the guidelines.

Four types of ownerships were included in the audit: federal, state, family or individual owners (often referred to as “non-industrial private forests” or “NIPF”), and corporate ownerships. All federal sites were on National Forests (also referred to in this report as “U.S. Forest Service”) while all state sites were on State Forests.

Consideration was given to approximately matching the number of audit sites on each ownership to the proportion of total Michigan timberland and timber harvesting which occurs on that ownership. The USDA Forest Service’s Forest Inventory and Analysis (FIA) 2010 timberland and 2008-2012 timber harvest data was used. For NIPF, the share of timber harvest operations is quite close to their percent of Michigan timberland. Corporate and state ownerships have a higher percent of harvest operations than timberland and the US Forest Service has a lower harvest percent than timberland.

Figure 1 displays each ownership's percent of total timberland, harvests, and audit sites. Overall, the number of sites audited by ownership was in line with the order and magnitudes of timber harvests by ownership. The state and corporate percent of audit sites are close to, but exceed their proportional percentages of total timberland and timber harvest. The U.S. Forest Service share of audit sites is appreciably above their harvest percent, but close to their timberland percent. If the U.S. Forest Service percent of audit sites was equal to its harvest percent, there would have only been two audit sites for that ownership, an untenable sample size. The Forest Service was dropped from the ownership analysis in 2011 due to too few audit sites. For 2014, by having more Forest Service sites, it was more legitimate to include the federal ownership in a BMP performance comparison across ownerships (see "Differences by Ownership Category" section and Table 10 later in this report.)

Figure 1. Ownership Percent of Michigan Timberland, Recent Timber Harvests, and Fall 2014 BMP Audit Sites



The NIPF percent of audit sites is appreciably below their percentage of total timberland and timber harvests. An increased number of U.S. Forest Service sites accounts for some of the reason NIPF audit sites are proportionately lower than the NIPF shares of timber land and harvests. However, past Michigan BMP audits and audits in other states indicate NIPF audit participation is also typically more difficult to achieve than the other three ownerships. Several reasons for this exist, including the dispersed nature of the NIPF ownership, more ongoing communications between the other three ownerships, including with regards to BMP audit preparations, heightened sustainable forest management concerns by the other three ownerships, and NIPF regulatory or enforcement concerns.

RESULTS

Introduction

The many different dimensions of the audit results are presented below. The primary focus is on statewide results. These will be reviewed in terms of summary statistics, performance by broad BMP category, highest and lowest performance items, and information from supplemental questions. Strengths and opportunities will also be examined.

An emphasis throughout the review of results is on comparisons with the 2011 audit. Consistency across the 2011 and 2014 results lends veracity to both audits. Possible causes for differences between the audit results are also discussed.

Additional observations and comparisons of the results are made across Michigan regions and ownerships, to other past Michigan audits, and to audit results from other states.

Statewide Results

Table 1 presents the summary statewide results from the thirty-six sites audited. Overall, 1107 of the 1250 BMPs (88.6%) assessed as needed were rated as being applied correctly. An additional 64 audited BMP circumstances were deemed to be acceptable variations. Combining these 64 acceptable variations with the 1107 BMPs applied correctly leaves only 79 BMPs or just over 6% applied incorrectly or not applied when needed. Only 34 cases of "needed and not applied" were coded out of 1250 cases (2.7%) where it was assessed that a BMP was needed (see Table 1).

Table 1. Fall 2011 BMP Summary Results (all ownerships)

	# of obser-vations	% of BMPs Needed
BMPs applied correctly	1107	88.6%
BMP acceptable variations	64	5.1%
BMPs applied incorrectly	45	3.6%
BMPs needed & not applied	34	2.7%
Sum of BMP applications needed	1250	100%
BMP applications not needed	1490	
Insufficient information	32	
Total BMP Applications Assessed	2772	

This is a high level of compliance with the BMPs and well above the level of 1996 and 1997 audits, but it is a slight decline from the 2011 results. Overall compliance results were 75% in 1996 and 82% in 1997. In 2011, the audit found 92.6% of needed BMPs were applied correctly while an additional 6.1% had acceptable variations. A slight decline from 2011 was not unexpected as the 2011 results were exceptionally high relative to BMP performances in other states and earlier Michigan audits. Also part of the decline may be attributable to one-third more total BMP applications being assessed in 2014 due to more specifications being added (the 2011 audit had 67 and the 2014 audit had 77) and more sites being audited (29 in 2011 versus 36 in 2014).

A common coding used in the BMP audits was "BMP applications not needed." As Table 1 indicates, a slight majority (1490) of possible BMP applications (2772) were assessed to be not needed. The maximum number of coded values for 36 sites and 77 BMP specifications is 2772; in contrast, in 2011 there were 979 "not needed" codings of a total of 1943 values for 29 sites and 67 BMP specifications. A majority of BMP specifications typically do not apply to individual audit sites as standards are developed to apply to the full range of possibilities which may be encountered in the field but often are not. As an illustration of this, a Wisconsin audit report (Shy and Wagner, 2007) states the condition "BMP not applicable to the site" applied more than 70% of the time to their audited sites in 2006. The percent of "not applicable" BMPs was of a similar magnitude in previous Michigan audits. In this regard, the large percent of "not applicable" BMPs is not an issue overall, but it may apply to individual BMP specifications where there are few instances of the need for the BMP or evidence of its application. Even where the sample size is somewhat limited, a pervasive lack of applicability may indicate that it is not a statewide problem. This issue will be returned to below with respect to sample size issues and with more specific 2011 and 2014 audit result examples.

"Insufficient information" was a coding used in those circumstances where a definitive rating otherwise could not be given by the audit team. The number of times this coding was used fell from 62 (3.2%) in 2011 to only 32 (1.15%) instances in the 2014 audit despite one-third more BMP assessments in 2014. At the minimal level used in 2014 it does not affect the results.

A relatively high level of BMP performance was also reflected in the auditors' qualitative findings for the supplemental questions. However, while the findings were generally good, they were not as high as they were in 2011 and point to the need for some additional monitoring and education. Four questions addressing the BMP performance on the audit sites required simple 1-word responses (see the "Supplemental Questions" at the end of Appendix B). In 2011, two sites were assessed to have slight soil and water quality impacts, but all 29 sites were deemed to meet or exceed expectations with regards to overall ratings considering BMP applications. In 2014, eight sites were found to have slight impacts and one was found with a moderate impact. With one site

exception, in 2011 there were affirmative assessments to the questions: "Did they implement all appropriate BMPs to control erosion (a system of BMPs)?" and "Did the system of BMPs control erosion and sedimentation?" For 2014, there were three negative responses to the question on implementation and six negative answers to the question about BMPs controlling erosion and sedimentation.

Temporary crossing; bridge was placed and removed twice for winter logging with no damage to bank; approach was then seeded and mulched.

The 2014 BMP Audit presented an opportunity to improve resource protection and to build on the partnership between DEQ and the forest products industry. DEQ appreciates the opportunity to be involved! - Steve Casey, UP District Supervisor, Water Resources Div., Dept. of Env. Quality

Four supplemental questions called for more elaborate auditor responses. They were:

1. What things went right on this site?
2. What things went wrong on this site?
3. Have other activities occurred on this site that potentially impact water quality? (ie ATV use, hunting traffic, grazing, etc.)
4. Are there mitigating activities that should take place on this site or is there corrective action already being taken?

Responses to the above questions are included in Appendix G. There was a wide variety of very positive observations, outnumbering the negative concerns raised. There was no single, pervasive concern reported, although "nothing" was a frequent response to the question "What things went wrong on this site?" The most frequent concerns cited related to rutting and culverts; these applied to a handful of sites. Seeding and/or successful regeneration was also cited in a few instances along with water diversion, water bars, and soil stabilization.

Five of the eight BMP categories at the statewide level had "applied correctly" audit results more than 90% of the time for those situations needing BMPs applied. (For a detailed listing of the BMP specifications for each of these categories, see Appendix B: Field Worksheet.) Two categories had over 95% of their BMP codings "applied correctly": Equipment Operation and Maintenance and Other considerations while the Landings category fell just short of that mark. Two categories, Stream Crossings and Skidding and Skid Trails, had overall compliance averages just above 82% while the Roads category was just under 86%. When combined with their "acceptable variation" codings, these three categories had BMP compliance just under 90%.

Table 2. Fall 2014 BMP Results by Category

Category	---------- BMP Needed ----------				Total of BMP Needed
	applied correctly	acceptable variation	applied incorrectly	not applied	
1 Equipment Operation and Maintenance	97.1%	0.0%	0.0%	2.9%	100.0%
2 Roads *(& road retirement)*	85.6%	3.4%	7.8%	3.1%	100.00%
3 Stream Crossings (permanent & temporary)	82.7%	5.4%	7.7%	4.2%	100.00%
4 Skidding & Skid Trails	82.1%	7.1%	1.4%	9.3%	100.00%
5 Landings	94.2%	5.8%	0.00%	0.00%	100.00%
6 Riparian Management Zones	91.5%	7.0%	1.2%	0.3%	100.00%
7 Wetlands	92.0%	0.00%	4.0%	4.0%	100.00%
8 Other Considerations	95.3%	4.7%	0.00%	0.00%	100.00%
Overall	88.6%	5.1%	3.6%	2.7%	100.00%

Five of the eight BMP categories also had negligible (0% to 1.5%) findings of BMPs applied incorrectly. The Wetlands category had 4% of its audit results coded as applied incorrectly while the Roads and Stream Crossing categories had closer to 8% coded in this fashion. With respect to a "not applied" audit finding, the Skidding & Skid Trails category stands out as having 9.3% of its needed BMPs coded as such. In 2011, only the Roads category had more than 2% of its total ratings in either an "applied incorrectly" and "not applied" codes combined (see Table 2). The 2014 results may

indicate future educational and audit attention should be given to Stream Crossing, Skidding & Skid Trails, and Road BMP categories.

Table 3 indicates that there were an appreciable number of observations of BMPs at the statewide category level to support the results presented in Table 2. The percent averages in Table 3 are based upon different numbers of BMP specifications and observations for each category. The highlighted "Wetlands" category has the fewest associated BMP specifications and observations of times when a BMP was needed, but there were twenty-five "BMP Needed" observations for it at the statewide level. A small number of observations does become an issue at the regional or ownership level as well as for individual BMP specifications within the BMP categories.

Table 3. Count of 2014 BMP Needed Observations and Total Possible Ratings by BMP Category

Category	# of Times BMP Needed	Total Possible Ratings	% BMP Needed of Total
1 Equipment Operation and Maintenance	68	108	62.96%
2 Roads	320	720	44.44%
3 Stream Crossings (permanent & temporary)	168	612	27.45%
4 Skidding & Skid Trails	140	288	48.61%
5 Landings	135	174	77.59%
6 Riparian Management Zones	330	540	61.11%
7 Wetlands	25	144	17.36%
8 Other Considerations	43	144	29.86%
Overall	1250	2772	45.09%

Auditors examining badly perched culvert.

Ratings for the 77 individual specifications can be evaluated in a number of ways. Future educational and monitoring efforts may be helped by noting which of the 77 BMPs had the highest and lowest percent compliance. The number of times which the individual 77 specifications were coded as “BMP needed” provides context as well.

Table 4 shows the BMP specifications having the highest number of sites with the BMP rated as being applied correctly or with an acceptable variation. The top part of the table shows those specifications which had high audit performance ratings in 2011, but the counts shown in the table are based upon the 2014 performance. As can be seen in the table, these high performance 2011 BMP items were found to also have high performance ratings in 2014. The lower part of the table shows additional specifications in 2014 with high performance (defined as being coded “applied correctly” or “acceptable variation” at least 75% of the time). These additional specifications were not highlighted as having high performance results in 2011.

Table 4. BMP Specifications with more than 27 "Applied Correctly" (A) and/or "Acceptable Variation" (V) Codings

2014 Results for BMP Specifications with High A & V Results in 2011 (BMP category and specification with page number in parentheses linking specification to BMP Manual)	2014 Category & Specifi-cation #	Applied Correctly	Accept-able variation
RMZs: Buffer strip clearly established. (pg 20)	7c	30	3
Skidding and Trails: Excessive rutting avoided: 6 inches deep and 25 foot long in RMZ, 12 inches deep and 50 feet long in other areas. (pg 64)	5f	27	1
Landings: Erosion control features functional, no movement of soil from the landing area. (pg 64)	6e	26	3
RMZs: Located roads, landings & skid trails outside strip where possible. (pg 21)	7l	30	1
RMZs: Leave late successional trees in RMZ	7g	29	0
RMZs: No logging slash/debris disposed from outside of strip into strip. (pg 21)	7i	27	0
Landings: Located outside RMZ. (pg 65)	6a	34	0
Landings: Provide for adequate drainage. (pg 65)	6b	32	0
Equipment Operation and Maintenance: Provided for adequate storage and disposal of fuel, debris, lubricants, fluids and rinsate from equipment cleanup. (pg 14)	1b	28	0
Roads: Excessive rutting avoided: 6 inches deep and 25 foot long in RMZ, 12 inches deep and 50 feet long in other areas. (pg 64)	2b	35	0
Landings: Re-vegetated/stabilized/leveled as needed	6f	26	5

Additional 2014 BMP Items with 27 (75%) or more As or Vs:

Retained sufficient cover to maintain shading of the stream to avoid increase in stream temp. (pg 20)	7h	27	0
Excessive rutting avoided: 6 inches deep and 25 foot long in RMZ, 12 inches deep and 50 feet long in other areas. (pg 64)	7j	28	0
Minimum width >=100 ft. (pgs 20, 22-23) Is there a designated trout stream less than 50 feet in width and appropriate widening of the RMZ (p 24 & 25)	7d	12	17
Regular road inspections performed and documented during and after harvesting (pg 38)	2n	30	0
Leave 60-80 BA and less than 10% of soil exposed within strip for shade tolerant spp. (pg 20)	7e	30	0
Soil compaction and scarification avoided. (pg 21)	7p	30	0
Obstacles: avoid gullies, seeps, springs, wetlands, and poor drainage areas where possible. (pg 31)	2i	32	0
Gullies, seeps and other permanently wet areas avoided where feasible. (pg 68)	5d	29	3
Located equipment adequate storage and maintenance sites outside buffer areas.	1a	33	0
Avoided placing roads in RMZ or were placed at a minimum distance of 100' from the stream (pg 31 & 34)	2a	30	3
Harvesting is timed for appropriate conditions and operations minimize rutting and compaction damage. (pg 70)	9d	35	1

Table 5 shows the 2014 results for the ten BMP Specifications where there were only three or fewer sites applied correctly or having acceptable variations in 2011. The number of sites where the BMP was deemed not applicable or there was insufficient information is also shown in the table. As this last column indicates, the audit results for the ten specifications in the top part of Table 5 indicate that the issue for these specifications was not that they were incorrectly or not applied, but rather that they were not applicable or that there was insufficient information to record if they were needed or how they were applied. In other words, there were too few sites where the BMPs were clearly needed or there was evidence about how they were applied from which to draw conclusions about compliance. (Table 8, below, addresses the issue of which specifications were incorrectly or not applied.) Once again, there is a high degree of correspondence between the 2011 audit results and the 2014 audit results. Only one specification, "Temporary water crossings satisfactorily removed at termination of harvest activity" had much of a change, going from two "applied correctly" codings in 2011 to seven in 2014.

An additional nine BMP specifications which had four or fewer "applied correctly" or "acceptable variation" audit results in 2014 and not noted for this in 2011 are listed at the bottom of Table 5. As with the specifications in the top half of the table, most of the issue with these additional specifications is that they were not applicable or there was insufficient information for them at the time of the audit.

These specifications with the greatest number of "BMP not applicable" or "Insufficient information" codings can be evaluated after each audit to determine if there is a possibility of looking for other evidence of the BMP or if the specification's wording could be modified for it to be relevant or needed.

Table 5. BMP Specifications with 3 or less "Applied Correctly or "Acceptable Variation" Codings

2014 Results for BMP Specifications with Low A & V 2011 Results (BMP category and specification with page number in parentheses linking spec. to BMP Manual)	Category # & Specification	Applied Correctly	Acceptable variation	Not Applicable or Insufficient Information
Skidding and Trails: Stream crossing permit obtained if skidding across stream. (pg 67)	5g	3	0	32
Skidding and Trails: Zigzag pattern – break grade to avoid long slopes. (pg 67)	5e	1	0	34
Skidding and Trails: Water bars properly installed as needed. (pg 40)	5b	3	1	29
Roads: Soil erosion & Sedimentation permit obtained for earth changes outside the sale area when 1 acre or more in size or if within 500 feet of stream. (pg 93)	2m	3	0	33
Stream Crossings: Temporary water crossings satisfactorily removed at termination of harvest activity. (pg 52 & 54)	4r	7	0	29
Wetlands Permit obtained for culverts, bridges, or construction in floodplains > 2 sq miles. (pg 10)	8c	2	0	34
Other Considerations: Site preparation and reforestation practices minimize soil disturbance, follow land contours, recognize RMZs, and avoid soil erosion. (pg 78-82)	9c	2	1	33
RMZs: State Natural River Plan or Wild and Scenic River Plan followed and permit obtained. (pgs 26-28)	7b	2	0	34
Roads: Broad base dips installed properly. (pg 45-47)	2d	2	0	31
Roads: Water bars properly spaced and installed where slope of road requires and where temporary cross drainage culverts were removed. (pg 40-44)	3b	1	0	32

Additional BMP Items with 4 or fewer As or Vs in 2014:		A	V	NA or 0
Broad base dips installed properly. (p 41,45-47)	4l	0	0	35
Non-forestry construction does not occur without a Part 303 permit from DEQ. (p 69)	8b	1	0	35
Energy dissipators at cross drainage and/or stream culvert outlets where necessary. (p 35)	2h	2	0	31
Cross drainage culverts properly sized (min 12") and installed. (p 49 & 50)	4n	1	1	33
Archeological sites are protected if known to be present. (p 11)	9a	2	0	31
Rare, threatened, and endangered species are protected if present. (p 12)	9b	2	0	31
Temporary cross drainage culverts and stream crossings removed. (p 38)	3a	3	0	32
Energy dissipators at cross drainage and/or stream culvert outlets where necessary. (p 35)	4p	4	0	31
Leave 20-25 BA or ¼ to ½ acre clearcut patches and less than 10% of soil exposed within the RMZ, for shade intolerant spp. (p 26)	7f	4	0	32

Table 6 shows the four specifications that had more than one site with an "Insufficient information" coding. The four specifications were in the categories "Other Considerations" (8a and 8b) or "Equipment and Operations" (1b and 1c). Under the current audit process, these specifications are not easily auditable in many cases. Other states have required proof of checking available state databases for protecting archeological resources and rare, threatened and endangered species. This provides auditable information for these specifications. Insufficient information on spills may be related to both the specification wording and ambiguity in the BMP Manual about a cleanup and a DEQ reporting threshold.

The "Other Consideration" specifications in Table 6 had their number of "insufficient information" codings significantly decrease from 2011 to 2014 (from 14 to 3 and 13 to 3) as they were coded "not applicable" instead. There was a slight increase in the number of "insufficient information" codings (from 3 to 8) for 1b, relating to adequate storage and disposal of fuel.

Table 6. BMP Specifications with 3 or more "Insufficient information" Codings

BMP Specification (BMP category and specification with page number in parentheses linking spec. to BMP Manual)	Category # & Specifi-cation	# of Sites Coded "Insufficient information"
Other Considerations: Archeological sites are protected if known to be present. (pg 11)	9a	3
Other Considerations: Rare, threatened, and endangered species are protected if present. (pg 12)	9b	3
Equipment Operation and Maintenance: Spills are cleaned up. If DEQ reporting threshold is met, then spill was reported. (pg 14 &15)	**1c**	9
Equipment Operation and Maintenance: Provided for adequate storage and disposal of fuel, debris, lubricants, fluids and rinsate from equipment cleanup. (pg 14)	**1b**	8

Table 7 shows those specifications where the "acceptable variation" coding was applied three or more times. This is a code which is not commonly used by other states nor was it used prior to 2011 in Michigan. In the review of 2011 data, there were also indications that it may have been applied inconsistently between regions and site comments did not always appear to be in line with the coding. In light of these issues, it is encouraging to see that its use was reduced in 2014 somewhat. Exceptions to this trend include the 7d RMZ specification which went from 8 to 17 acceptable variation codings and two other specifications relating to revegetating and rehabilitating landings and skid trails.

Table 7. BMP Specifications with 3 or more "Acceptable Variation" Codings

BMP Specification (BMP category and specification with page number in parentheses linking spec. to BMP Manual)	Category # & Specif-ication	Applied Correctly	Acceptable variation
Stream Crossings: Sediment not being discharged into stream. (pg 63)	4i	8	1
Roads: Erodible soils stabilized by seeding, natural vegetation or brush. (pg 40)	3d	18	1
Wetlands: Excessive rutting avoided: > 6 inches deep and 25 feet long. (pg 64)	8d	14	0
Skidding and Trails: Gullies, seeps and other permanently wet areas avoided where feasible. (pg 68)	5d	29	3
RMZs: Buffer strip clearly established. (pg 20)	7c	30	3
Skidding and Trails: Excessive rutting avoided: 6 inches deep and 25 foot long in RMZ, 12 inches deep and 50 feet long in other areas. (pg 64)	5f	27	1
RMZs: Minimum width >=100 ft. (pgs 20, 22-23) Is there a designated trout stream less than 50 feet in width and appropriate widening of the RMZ? (pg 24 & 25)	7d	12	17

Additional BMP Items with 3 or more "Vs" in 2014:

Re-vegetated/stabilized/leveled as needed	6f	26	5
Rehabilitate skid trails as needed. (pg 68)	5h	20	4
Avoided placing roads in RMZ or were placed at a minimum distance of 100' from the stream (pg 31 & 34)	2a	30	3
Crown road on sections crossing level ground or low areas. (pg 34)	2c	13	3
Erosion control features functional, no movement of soil from the landing area. (pg 64)	6e	26	3

Slash ineffective in controlling run-off from road

While the instances of noncompliance were in a small minority, more were found than in 2011. Half of the 77 BMP specifications had no instances of "Applied Incorrectly" or "Not Applied." The other half (38) are listed below with the counts of sites found to have incorrectly or not applied BMPs where they were needed. In 2011 only 11 out of the 67 specifications had either of these codings and only one of them ("Drain surface water into filter strip or vegetative draw") had two instances of such ratings (see Table 8). In contrast, the highlighting below indicates the specifications in 2014 which had 4 or more codings indicating noncompliance.

Table 8. BMP Specifications Receiving "Applied Incorrectly" or "Not Applied" Codings

BMP Specification (BMP category and specification with page number in parentheses linking spec. to BMP Manual)	Category # & Specification	# of sites applied incorrectly	# of sites not applied
Roads: Broad base dips installed properly. (pg 45-47)	2d	1	2
Roads: Water bars properly spaced and installed where slope of road requires & where temporary cross drainage culverts were removed. (pg 40-44)	3b	1	2
Equipment Operation and Maintenance: Located equipment adequate storage and maintenance sites outside buffer areas.	1a	0	0
Roads: Roads follow contour with grades between 2% and 10%. Grades exceeding 10% do not exceed 300' in distance. (pg 32)	2b	0	0
Roads: Water diversion ditches installed properly. (pg 40-48)	2e	6	0
Roads: Drain surface water into filter strip or vegetative draw. (pg 47-49)	2g	3	0
Roads: Obstacles: avoid gullies, seeps, springs, wetlands, and poor drainage areas where possible. (pg 31)	2i	1	0
Roads: Roads out sloped where gradient permits. Where in-sloped (gradients >15%), adequate cross drainage is provided to protect water quality. (figure 4, pg 36)	2j	0	1
Skidding and Trails: Rehabilitate skid trails as needed. (pg 68)	4h	0	2
RMZs: Buffer strip clearly established. (pg 20)	6a	0	0
Wetlands: Wetland crossings include placement of culverts and other structures to ensure adequate water flow and drainage. (pg 70-74)	7e	1	0

Additional BMP Items receiving 1s or 2s in 2014:

Spills are cleaned up. If DEQ reporting threshold is met, then spill was reported. (pg 14 &15)	1c	0	2
Crown road on sections crossing level ground or low areas. (pg 34)	2c	3	0
Cross drainage culverts properly sized (min 12") and installed. (pg 49 & 50)	2f	2	0
Energy dissipators at cross drainage and/or stream culvert outlets where necessary. (pg 35)	2h	1	2
Road cuts sloped and stabilized to minimize water quality impacts. (pg 35)	2k	1	2
Temporary cross drainage culverts and stream crossings removed. (pg 38)	3a	1	0
Erosion control features functional. (pg 40)	3c	3	0

Erodible soils stabilized by seeding, natural vegetation or brush. (pg 40)	3d	1	1
Properly close and/or sign abandoned or infrequently used roads. (pg 39)	3f	1	0
Stream crossing permit obtained and followed. (pg 8)	4b	1	1
Stream bank approaches properly designed. (pg 54-55)	4e	1	0
Crossings do not impede fish migration. (pg 54 & 59)	4f	5	0
Culverts properly armored if needed. (pg 56)	4h	0	1
Sediment not being discharged into stream. (pg 63)	4i	6	0
Water bars properly installed as needed. (pg 40 & 42)	5b	0	3
Drain surface water into buffer strip or vegetative draw with energy dissipators as needed. (pg 67)	5c	0	1
Gullies, seeps and other permanently wet areas avoided where feasible. (pg 68)	5d	0	3
Zigzag pattern – break grade to avoid long slopes. (pg 67)	5e	1	0
Excessive rutting avoided: 6 inches deep and 25 foot long in RMZ, 12 inches deep and 50 feet long in other areas. (pg 64)	5f	0	4
Stream crossing permit obtained if skidding across stream. (pg 67)	5g	1	0
No logging slash/debris disposed from outside of strip into strip. (pg 21)	7i	1	1
Streams, lakes, open-water wetlands free of slash. (pg 20 - 21)	7k	3	0
Excessive rutting avoided: > 6 inches deep and 25 feet long. (pg 64)	8d	1	1
Water diversion ditches installed properly. (pg 41, 40-48)	4m	0	2
Broad base dips installed properly. (pg 41,45-47)	4l	0	1
Cross drainage culverts properly sized (min 12") and installed. (pg 49 & 50)	4n	0	1
Energy dissipators at cross drainage and/or stream culvert outlets where necessary. (pg 35)	4p	0	1

Other Observations & Comparisons

Differences by Michigan Region

There are significant vegetative, topographic, social and economic differences across the three northern Michigan regions (northern lower peninsula (NLP), eastern peninsula (EUP), and western peninsula (WUP)). For example, relatively speaking, the WUP has more topographical issues, the EUP has more lowland forests, and the NLP has more people and non-timber forest activities (e.g. second homes, recreation, and oil and gas development). There were also differences in the regional BMP audit teams, although some auditors did work on multiple audits and multiple disciplines were represented on all audit teams. Given these regional differences, one might expect that there would be differences between regional audit results. Table 9 shows the audit results by region.

Table 9. BMP Coding Regional Averages

% of BMP Needed Sum:	NLP	EUP	WUP	Statewide
applied correctly	97.7%	82.0%	85.9%	88.6%
acceptable variation	2.1%	12.8%	3.0%	5.1%
sum of A & Vs:	99.7%	94.8%	88.9%	93.7%
applied incorrectly	0.0%	3.6%	6.1%	3.6%
not applied	0.3%	1.6%	5.0%	2.7%
% of Total Coding Sum:				
applied correctly	40.6%	27.1%	52.2%	39.9%
acceptable variation	0.9%	4.2%	1.8%	2.3%
applied incorrectly	0.0%	1.2%	3.7%	1.6%
not applied	0.1%	0.5%	3.0%	1.2%
Not Applicable	58.0%	64.0%	39.3%	53.8%
Insufficient Info	0.4%	3.0%	0.0%	1.2%
Needed Sum	41.6%	33.0%	**60.7%**	45.1%
Total Sum	100%	100%	100%	100%

Overall, the audit results are relatively similar across the regions and quite similar to 2011 results. Combining the percent of “acceptable variation” coding with the percent coded “applied correctly” results in close values across regions. As was the case in 2011, the NLP had the highest performance in 2014, followed by the EUP and then the WUP. This can be seen either through looking at the sum of correctly applied BMPs and acceptable variations or the applied incorrectly and not applied percents in Table 9.

There are a number of differences worth noting, however. Some cells in Table 9 are highlighted to draw attention to these differences. One difference is that the WUP and EUP reversed their use of the “acceptable variation” coding. In 2011, the coding was 2.7% of the BMPs Needed in the EUP, while it was 9.2% for the WUP. For 2014, the EUP’s use of it jumped to almost 12.8% while the WUP reduced its use to just over 3%. The pattern of the percent of sites needing BMPs remained quite similar across the

regions. In 2011 the "needed sum" percents were 47.8%, 30.8% and 58.5% for the NLP, EUP, and WUP. For 2014, the NLP and EUP became more in line with each other, with the NLP dropping to 41.6% and the EUP increasing to 33.0% while the WUP percent grew slightly to 60.7% (see the green highlighting in Table 9). The corollary to this is that the WUP also has a much lower percent of "not applicable" BMPs. While the EUP had almost 64% and the NLP had 58% of their audited BMPs "not applicable," the WUP was only 39%.

Having more applicable BMPs is certainly one explanation for the WUP performing slightly lower than the other two regions; more BMPs needed means more opportunities for error or poor implementation. Perhaps there is more opportunity for BMP runoff issues from WUP slopes than rutting in EUP lowland forests because of the WUP's greater topographical issues and relatively fewer harvests in EUP lowlands.

Several additional factors may account for the extremely high performance in the NLP. These include:

- more well-drained soils less conducive to the sedimentation and rutting problems seen in parts of the UP,
- more roads and road access, which also means fewer needs for and problems on logging roads and skid trails,
- smaller timber tracts which entail fewer visits and less time creating ruts, sedimentation, and other issues,
- more non-industry users of the sites and many more non-industrial private forestland owners (NIPF) who may be more sensitive and complain more about logging practices. Seven of the twelve sites in the NLP for the 2014 audit were NIPF while the WUP (with 2) and the EUP (with 1) only had three NIPF owners total.

Future audits will continue to lend clarity to why there are differences between the three regions, but the 2011 and 2014 audits together indicate there is a very high level of performance in the NLP and that there are higher requirements for WUP BMP implementation.

Differences by Ownership Category

Four major ownerships participated in the BMP audit: corporate lands, state lands (state forests only), NIPF, and federal lands (national forests or U. S. Forest Service). BMP performance for audit sites of the four ownerships is shown in Table 10. The differences in the results across these ownerships are negligible. If the sites were drawn as a perfectly random sample, the overall rates of compliance shown in Table 10 should not be viewed as significantly different in a statistical sense due to their similarity in size and the small number of sites audited.

It should be noted that the corporate ownership is weighted towards sites in the WUP which, as the previous section indicated, had the highest percentage of sites needing

BMPs. At the other extreme, most of the NIPF sites are in the high-performing NLP region. Audit results for these ownerships may be largely reflecting regional factors. Also, it should be noted that on the one hand, the corporate ownership has the lowest percentage of "applied correctly" (84.6%) results for BMPs needed, but on the other hand, it also has the highest percentage of BMPs applied correctly (49.8%) overall. In fact, the Corporate ownership has a higher percentage of cases where BMPs were deemed needed (59% compared to the State's 38%, the NIPF 40% rate, and the National Forests' 46%). If more BMPs needed were associated with more BMPs applied incorrectly or not applied, one would expect lower corporate compliance, but that was not found in the 2011 audit, while it was only slightly lower (and statistically not different given the small sample size) in the 2014 audit.

Table 10. BMP Codings by Ownership

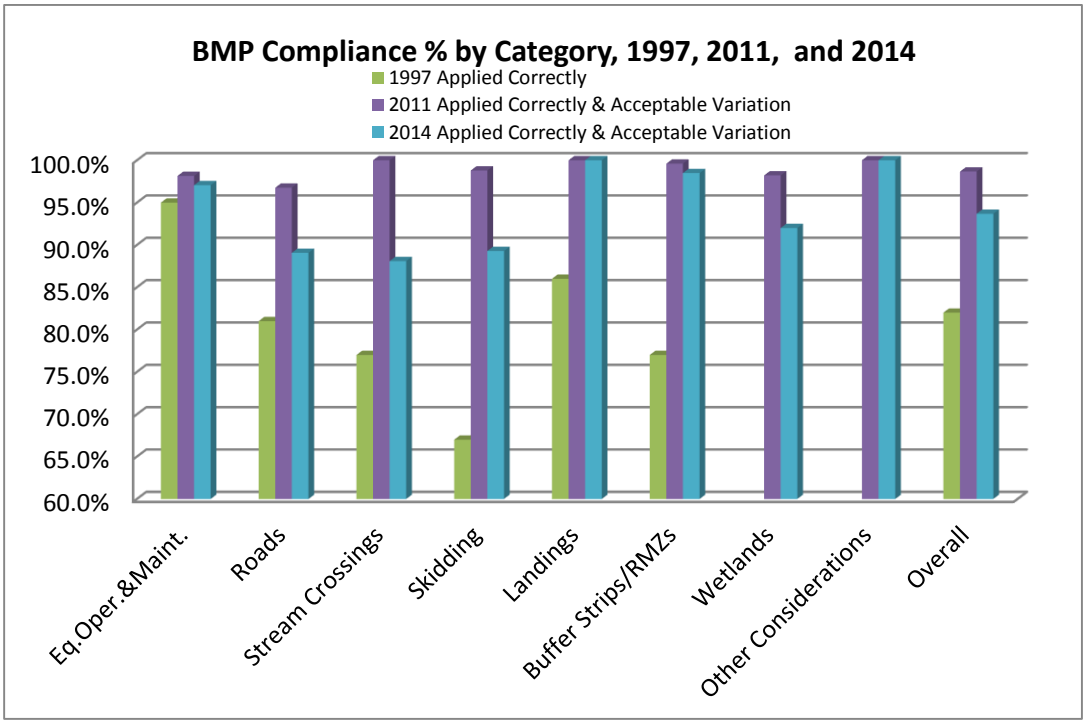
Ownership:	Corporate	State	NIPF	National Forest
# of Audit Sites:	9	11	10	6
% of Needed Sum:				
applied correctly	84.6%	89.8%	92.2%	89.2%
acceptable variation	5.6%	6.2%	3.6%	4.7%
applied incorrectly	6.1%	1.9%	1.6%	4.2%
not applied	3.7%	2.2%	2.6%	1.9%
% of Total Sum:				
applied correctly	49.8%	34.2%	36.8%	40.9%
acceptable variation	3.3%	2.4%	1.4%	2.2%
applied incorrectly	3.6%	0.7%	0.6%	1.9%
not applied	2.2%	0.8%	1.0%	0.9%
Not Applicable	40.0%	60.6%	59.1%	53.0%
Insufficient Info	1.2%	1.3%	1.0%	1.1%
blank/unusable	0.0%	0.0%	0.0%	0.0%
Needed Sum	58.9%	38.1%	39.9%	45.9%
Total Sum	100.0%	100.0%	100.0%	100.0%

Comparison with other past Michigan audits

Comparisons across forestry BMP audits may be questionable because of possible differences between audits, even within the same state. These differences may include weather conditions, number and types of sites visited, auditing participants, auditing codes, and BMP applications audited. Many of these differences apply to a comparison of Michigan's 2011 and 2014 audit results to earlier audits carried out in 1996 and 1997. However, the 2011 and 2014 audit process - including the forms, questions and BMP specifications - was largely based upon and quite similar to the earlier Michigan audits.

The 1996 report indicates there was an overall compliance rate of 75% for the 60 sites included in the 1996 audit. The 1997 report indicates the average compliance was 82% for the 54 sites audited that year. While the 1996 report did not include a summary of performance by category, the 1997 report did include such a summary. In descending order, they found the Equipment Operation and Maintenance category had the highest rate of compliance at 95%, Landings and Roads categories both were 81%, Water Crossings and Buffer Strips both were 77%, and Skidding had the lowest rating at 67%. Figure 2 shows a comparison between the 1997 BMP Category results to 2011 and 2014 category results. The 2011 and 2014 results are shown with "applied correctly" results combined with the "acceptable variation" results. Although some different specifications and categories are used in 2011 and 2014, there appears to have been improvement across the board from 1997, with the exception that Equipment Operations and Maintenance was similar because it was rated quite high in 1997.

Figure 2. BMP Compliance Percent by Category, 1997, 2011, and 2014 audits



The 2014 results by BMP category tend to be slightly lower than the 2011 results. The category which appears to have had the greatest drop in compliance between the 2011 and 2014 audits is the stream crossing category. However, this drop is misleading for several reasons. For example, while 75% of the WUP audit sites had applicable stream crossing BMPs in 2014, only 60% of the 2011 WUP sites required them. Furthermore, 8 of the additional 10 BMP specifications for the 2014 audit were added to the stream crossing category. Finally, if only the applied correctly results are contrasted (ignoring the acceptable variation results), the 2014 results are less than 3% below the 2011 results (82.74% vs. 85.5%) which is not statistically different.

In sum, while the 2014 results indicate there may have been a slight dip from the 2011 results, the differences are quite minimal and there are several reasons to expect slight differences from the exceptionally high 2011 results. Overall, the 2014 results reinforce

the evidence that there has been an ongoing high level of BMP implementation relative to earlier 1996 and 1997 audits.

An important dimension of the 1996 and 1997 audits was the emphasis that the audit results could not be extrapolated to all timber harvest activities in the state nor to different ownerships. The Executive Summary of the 1997 report noted in this regard:

- "The methods and sources used to create the site pool from which the audited sites were selected have serious limitations in terms of accurately representing what was occurring in Michigan with regards to forest landowners and water quality."
- "The information and data presented in this report are **not statistically significant** and **cannot be interpreted** as a valid representation of what is actually happening on the ground." *(bolding in original text)*

Despite these caveats, the report concluded that the data could be used for general and relative comparisons. However, the primary strength of the audit process was said to be that it provided a positive and productive approach which generated good information for future educational efforts and an excellent opportunity for positive interaction between professionals with varying backgrounds. The same held true for the 2011 and 2014 audits.

<u>Comparison with Other States' BMP Audits</u>

Wisconsin and Minnesota have similar forests to Michigan. Combined, the three states are often referred to as the "Lake States." While the three states take some significantly different approaches to BMPs, it would be expected that they also share some similarities because often the same companies operate across state lines, they share similar climate, topography, and vegetation. Another important factor is that forest management across the three states has been engaged in forest certification efforts for over 15 years.

Overall, BMP compliance was estimated at 83% in Wisconsin for the 1995 through 2003 period (see Shy, 2007). A 2006 audit covering just federal and industrial sites showed improvement (Shy and Wagner, 2007). It stated for federal timber sales, "BMPs were applied correctly where needed 95% of the time" and industrial timber sales had a very similar estimate of 94%. This appears similar to 2011 audit results found in Michigan and slightly better than the 2014 Michigan results.

The most recent published Minnesota report (Dahlman, 2010) does not provide an overall compliance rate, but states "Overall implementation of the guidelines was similar to previous reports." Minnesota's audits also are broader than Michigan's, monitoring more forest management practices than just water or soil BMPs. For example, while Michigan's BMP audits incorporate a category of "other considerations," including cultural resources and Threatened and Endangered (T&E) species, in addition to these, Minnesota monitors coarse woody debris and visual quality.

Other highlights from Wisconsin and Minnesota BMP reports include the following:

- The sample size of the Wisconsin and Minnesota annual audits have tended to be more than double the 36 sites in the Michigan 2014 audit.
- Both have overcome the issue of randomness or representativeness of the audit sites, but through different means. Minnesota employs an impressive, but relatively expensive remote sensing and aerial photo assessment of where disturbances occur while Wisconsin relies upon timber harvest databases developed for other programs.

See the references for more detail on the BMP programs in Minnesota and Wisconsin.

Primary Issues for Future Audits

The following strengths and weaknesses of the Fall 2014 audits were provided by audit team members. The list of strengths includes several items which were viewed as opportunities in the 2011 audit report:

Strengths:

- protecting anonymity of auditees for summary reporting;
- balance and experience of audit teams; each audit team had at least one member who participated in the 2011 audit;
- DEQ representative on each audit team;
- substantial USFS participation (providing audit sites & membership on audit team);
- forester or landowner representative to guide to site and answer questions;
- additional categories (e.g. soil type, designated trout stream, and other ones) on site selection spreadsheet along with greater focus on stream crossings for site selections;
- used regional proportions of harvesting by ownership as more of a guide for site selection;
- improvements made to field worksheet and rating guide (added road inspection program to worksheet;
- availability of GPS coordinates;
- one company has reported evaluating its internal policy as a result of the audit.

Opportunities:

- site maps in advance of audit (aid in site selection);
- although there was progress with the 2014 audit relative to the 2011 audit, additional NIPF sites (gatewood/open market-Master Logger and Timber Producers as possible source?) would be appropriate;
- additional review of field worksheet.
- request field inspections (if available) of auditors prior to BMP audit.

The following items may be added to these:

- Continue to review appropriate auditing of protection of archeological resources and rare, threatened and endangered species. Consider a two-step audit process: one step would be documentation of checking databases for the presence of such resources and another would be protection steps taken if such resources are found. (The latter step will often be determined to be "not applicable" based upon the earlier step of checking the databases.)

- The lack of a random sample of sites was a major concern for earlier Michigan audits and this concern continues to apply to the 2014 audit. For extrapolations to harvest operations beyond those audited, the sites must be from a random, representative sample. More than 140 sites were submitted for consideration. This pool of sites that the audit team leaders selected from were not randomly selected, therefore it is uncertain as to whether sites are truly representative. However, it is noteworthy that the site selection criteria included a preference for timber sales with DEQ permitted stream crossings, unlevel or steep terrain, wetlands, riparian zones, road construction, and other types of buffer zones. The intent was to select higher risk sites where application of BMPs were needed more than average. In essence, the audit was biased towards sites with more difficult-to-achieve BMP compliance than typical timber harvest operations.

- The sample size (number of audit sites) and frequency of audits should be assessed in order to ensure Michigan BMP audits generate statistically-sound results. While there are many general statistical guides available, two BMP-related references for this issue are "The Statistical Guide for BMP Implementation Monitoring" (Southern Group of State Foresters' Water Resource Committee, 2008) and Minnesota's "Site-Level Monitoring Program Review" (Turner, 2008).

  To ensure reasonable margins of error for statistical extrapolations and evaluations of trends, a minimum number of sites should be sought for items or groupings within categories of interest (i.e. each major ownership class, region, or BMP specification). Having 30 sites as a minimum for each item or grouping would achieve this and result in the total number of audit sites likely being in a range of 75 to 100 or more. Further review of this issue as to what is possible and what is a priority would be appropriate. Achieving a sound sample size which permits generating statistics for more than just statewide estimates is likely to be more important than having frequent audits. Ownership and regional differences are of interest to people and enable better targeting of educational and training efforts.

- Wisconsin has adopted annual audits but with rotating ownerships each year. Minnesota reviewed its choices with respect to establishing and maintaining a regular schedule for monitoring and reporting (Turner, 2008). Three alternative scenarios were considered: 1) Go to every two years (annual audits are not necessary if the audits have adequate samples), 2) Go to either a subset of guidelines or a substate region annually (a subset of guidelines may not save as much as concentrating audits in a substate region – ed.), and 3) Do field monitoring for two years then report generation in a third year. As of early 2012, Minnesota is planning on audits every other year, but future budgets could impact those plans. As indicated previously, Wisconsin has adopted a variant of Minnesota's alternative scenario #2, rotating ownerships by year.

- Pursue means to leverage the investment and information the USFS Michigan National Forests have with their internal BMP monitoring and what individual SFI IC members have in their internal BMP monitoring. This could involve working with logging interests to reduce redundancies. Although such monitoring may vary by firm and be a part of company policy established outside of the State of Michigan, the possibility of efficiencies and strengthening of monitoring results makes this worth ongoing consideration.

- To help the auditing be consistently and objectively achieved, auditor training should be expanded to assure uniform assessment of BMPs and the individual specifications should be reviewed to make as many of the BMP specifications clearly auditable and operational. At the same time, consideration should be given to maintaining continuity so that data can be compared across years.

- The "acceptable variation" coding is an ongoing discussion item. The WUP decreased its use of the coding while the EUP increased its use. This raises questions about the consistent application of the coding across regions and across audits done different years. There are cases where auditor comments seemed to indicate that practices may not have been in full conformance with the BMP manual, yet they received an "acceptable variation." Reasons to use this qualified coding include that there is a tremendous amount of variation in field conditions and all possibilities cannot be captured in a brief document like the BMP Manual. As noted in the BMP Manual Foreword, "This manual provides recommended guidance and specifications. It does not cover all situations, as conditions vary from site to site. These practices may be modified for specific site conditions in line with protecting soil and site productivity, and water quality resources." However, the "acceptable variation" coding is not used by other states' BMP audits and its use should be revisited to ensure it is consistently applied. This issue may also reflect a need to revisit and possibly update portions of the BMP manual.

Summary and Conclusions

The 2014 Michigan BMP Audits recorded continuing high performance across all BMP specifications, regions, and ownerships. Although they dipped slightly from exceptional 2011 results, the results were significantly higher than 1996 and 1997 audit results. They reflect ongoing effective education, training, and field attention to maintain or improve soil and water quality practices in Michigan's timber harvesting and forest road construction activities.

The results point to where future educational efforts should be targeted. Training and educational efforts could be aimed at the BMP category which had the highest number of non-conformances with the BMP Manual. However, all eight BMP categories had their overall implementation rated as applied correctly or acceptable variation above ninety-two percent. The Roads category had the largest number of specifications (seven) with non-conformance ratings, but the Roads category also has the largest number of BMP audit specifications and thereby simply mathematically more potential for specifications with a stray instance of non-conformance.

One other further step which could be taken is to check original field worksheet comments for each audit site to see if there are commonalities that could, in turn, be the focus of future educational efforts. Otherwise, the lesson may be not so much that particular practices need to be focused upon, but rather that the educational, training, and SFI certification standards which are in place are working and need to be continued.

The audit results indicate two areas of the BMP audit program could benefit from receiving some attention. These have to do with where "acceptable variation" and "insufficient information" codings were more frequently assessed. Stream Crossings and Skiddings and Skid Trail categories had distinctively higher percentages of "acceptable variation" codings. These need to be reviewed to assure consistency and transparency on what is acceptable versus not reflective of the BMP standards. Similarly, the primary concern with "insufficient information" is to review the audit language for means to minimize situations where it is applied.

Another ongoing discussion item regarding Michigan's audits has been how to achieve a truly representative, random sample. This is linked to the issue of how frequent and what the size of future audits should be. If there is not an assurance that the sample is representative of broader harvest activities, statistics cannot be used to extrapolate information about harvest activities from the sites being audited. Also, even with confidence that a representative sample has been achieved, a small number of audit sites means there will be such broad confidence ranges around the results that trends over time cannot be derived with certainty. Size and frequency of audits remain important for determining maintenance of BMP concerns and high levels of implementation success, but they are not the primary factors in estimating the overall actual levels of BMP performance. If no reasonable means of assuring a random sample can be found, then the applicability of the audit results to all

Michigan timber harvests may be suspect, but the audits themselves would still provide good opportunities for collaboration and valuable information on trends over time.

Concerns about an adequately-sized, representative sample have been addressed. A Michigan Department of Agriculture and Rural Development appropriation for fiscal year 2014-15 will enable a larger number of sites to be systematically audited. It will be carried out by a contractor which may eliminate any biases in the results which may have been introduced by having different regional audit teams. Comparisons with the 2011 and 2014 results will be part of the contractor's required work plan and the overall effort should shore up a solid statistical foundation for how BMPs are applied in Michigan across regions and ownerships.

A great deal of resources and coordination went into planning and implementing the 2014 audit. It was a grass roots effort, initiated by the MI SFI IC to evaluate implementation of Best Management Practices and to continue improving auditing methodology and identifying BMP issues. This effort has been successful and its results point to a high level of BMP performance among SFI IC participants and Michigan's three National Forests. The effort has also provided a sound basis for future audits and the ongoing maintenance of Michigan forestry soil and water quality practices.

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Appendices

A. SFI IC BMP Audit Proposal and April 2, 2014 Conference Call Notes
B. Field Worksheet (includes list of BMP audit items and rating guide)
C. Site Selection Spreadsheet
D. List of Michigan SFI IC Member Companies/Organizations, December, 2014
E. Committee and/or Audit Team Members
F. Responses to Audit Field Worksheet Supplemental Questions

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2014 FOREST SOIL AND WATER QUALITY Audit Proposal (5/14/14)

Overview:

The Michigan SFI Implementation Committee (SFI IC) and others will be conducting BMP audits on 36 sites that will be located in the Northern Lower, Western Upper, and Eastern Upper Peninsulas in August and September 2014.

Primary Objective:

1. Use BMP monitoring data as a means to target future education efforts and technical assistance. (logger, landowner, forester, road builder)
2. Educate participating landowners about the importance and use of BMPs when conducting timber harvesting activities.
3. Promote voluntary conformance with BMP guidance within the state.
4. Evaluate best management practices of SFI Program Participants and the USFS, while meeting the needs of member companies for SFI certification.

Scope of Project:

- 12 sites per region, 36 sites total
    - Each SFI Program Participant and USFS (Ottawa, Hiawatha, Huron-Manistee) will be asked to submit 10 locations, per region where operations exist), that fit the BMP site selection criteria. (USFS and MI DNR sales cannot be submitted by companies)
- Three audit teams consisting of 4 persons per teams
    - Two SFI IC representative on each team
    - One DNR FMD representative on each team
    - One DEQ or DNR Fisheries staff on each team
    - Invite attendance by:
        - Landowner will be invited to accompany auditors observe audit
        - Other conservation partners will be invited to observe audit
        - Logger will be notified and invited to observe audit
    - Audit Team leaders will be appointed by the SFI IC BMP Subcommittee Chair
- Land ownership types represented:
    1. State forest land
    2. National forest land (dependent on USFS participation)
    3. Non-industrial private lands and
    4. Corporate lands

- Audit Results will be compiled by the SFI IC BMP Subcommittee and results will be published on the SIC website, DEQ and DNR websites. Other publicity opportunities will be explored.

Timeline:

- May 6 - hold SFI IC executive committee conference call to discuss project proposal and other meeting issues.
- May 21 – target date for developing final draft project proposal
- May 21 have the weeks for the audit selected and audit teams selected.
- May 21- present final proposal, site selection process and training plan to SIC for approval
- July 15- SIC member companies deadline to submit sites
- July 15- three groups of BMP auditors identified, training to commence
- August – September - conduct BMP audits (Audit team leaders determine timing).

Site selection:

- The following criteria will be used to select site:
  1. Timber sales harvested (and completed or nearly complete) between May, 2013 and September, 2014
  2. A body of water is located in or very near the sale
  3. Minimum sale size of 5 acres
  4. Site located no more than one half mile from a road or trail accessible with a two wheel drive vehicle.
  5. Sale with rolling or steep terrain, wetlands, vernal ponds, riparian zones, road construction, and other types of buffer zones are preferred (see BMP audit site selection worksheet for more detail).
  6. Location related to other sites will be considered
- SFI Participants and USFS will be asked to fill out a BMP Audit Site Selection worksheet for each proposed site. Each SFI Participant will provide 10 sites per region of operation, selected per the above selection criteria.
- The SFI SIC BMP workgroup will review submitted Audit Site Selection Spreadsheets and select locations based upon meeting the above criteria, ownership class, and location.
- 12 sites will be chosen in each region, the Western UP, Eastern UP and the Northern Lower Peninsula (36 sites total). Landowner permission must be obtained prior to auditing, (landowner, logger, and forester invited).

Auditing

- Audits will be conducted in August and September of 2014.
- Three audit teams composed of at least 4 people will evaluate each site using the 2014 Forest Soil and Water Quality Field Worksheet.
- Sites will be rated on the severity of non-conformance based on 8 areas of focus derived from the DNR/DEQ Sustainable Soil and Water Quality Practices on Forest Land manual:

1. Equipment Operations and Maintenance
2. Roads
3. Stream Crossings
4. Skidding and Skid Trails
5. Landings
6. Riparian Management Zones
7. Wetlands
8. Other Considerations such as T&E species, archeological sites, artificial regeneration.

- Each recommended best management practice will be ranked as: A -- BMP NEEDED, APPLIED CORRECTLY, V – BMP NEEDED, ACCEPTABLE VARIATION, 1 – BMP NEEDED, APPLIED INCORRECTLY, 2 – BMP NEEDED, NOT APPLIED, NA – BMP NOT APPLICABLE, 0 - INSUFFICIENT INFORMATION TO RATE.
- The audit report will indicate where strengths and weaknesses exist and where BMP training is needed.
- The SFI Program Participant is responsible for obtaining appropriate permission to visit selected BMP audit sites. Landowner and possibly logger permission is required.
- Confidentiality:
  - Landowner will be advised of observations
  - Law Violations may be referred to the DEQ or the proper enforcement authority
  - Law violations will be reported to the SFI participating company.
  - Auditor protocol on confidentiality (derived from section 9 of the SFI Program Requirements):
    - All information and documents, including working drafts and reports, shall be considered confidential. SIC members and auditors shall not release any information or documents without the prior permission of the SIC. Auditors shall conduct themselves in a professional and ethical manner.
    - Prior to engaging in an audit, audit team members shall disclose to the SIC and audit team members their relationship to the property to be audited.
- Site selection process – audit teams will select sites with assistance and input from the SIC BMP Subcommittee.

Additional information included with proposal: 2014 Forest Soil and Water Quality Review Field Worksheet and BMP Audit Site Selection Worksheet

Notes from conference call 4-2-14

BMP Field Audit conference call 4-2-14 9 AM.
Attendees – Howard Lindberg, David Price, Mitch Koetje, Jessica Turino Kernohan, Jennifer Burnham, Amy Amman, Warren Suchovsky, and Scott Robbins
Howard welcomed everyone and made introductions.
He then discussed the conference with Larry Pedersen on March 31, 2014. Larry has agreed to author the final 2014 BMP report. We discussed the benefits of 36 sites vs. 30 sites. Larry will give us a cost estimate for his work. He will also calculate the land ownership classes for the 3 regions we will be auditing.
Scott and Howard spoke with DEQ's Steve Casey on April 1, 2014. We discussed DEQ's commitment to the participation on the audit teams. He was also asked to see if DEQ would be able to hold landowners/loggers harmless for finding during the audit.
Howard reviewed the audit teams and it was determined that there will be four person teams, with leaders being himself in the WUP, Jessica in the NLP, and Andy in the EUP. Observers were discussed and who to invite. Warren Suchovsky and conservation groups such as The Nature Conservancy will be considered. This will be discussed in further detail during the May 21, 2014 MI SFI IC meeting.
There was a discussion on publicity opportunities after the report is completed. Various websites were suggested such as SFI, DNR and DEQ. Press releases will be another option to pursue.
Site selection was discussed and how the process will work in picking sites.
Timeline targets – have the proposal finalized by May 21, 2014. Have the weeks in which the audits will be conducted selected by region finalized by May 21, 2014.
Training for audit team members was discussed. A review of the 8 areas of focus and the rating system will be conducted so everyone is on the same page. We also need to define acceptable variation so that everyone has the same understanding.
Jessica discussed the site selection process and the importance of gate wood sites being selected and adequately represented in this audit.
Warren brought up vernal pools and defining them.
Jennifer suggested making the sites accessible within a ½ mile instead of a mile.
Make sure there are some sites that were winter harvested are represented and perhaps we should ask the members providing the sites to specify the season the harvest took place.
GPS coordinates will be requested.
There will be a forester who administered the sale will be requested to be present and/or the landowner / logger.
Use rolling instead of "unlevel" on number 5 of the site selection criteria. Add vernal pools to number 5 of the site selection criteria.
Timeline notes - Site Submission July 15, 2014, Training July 15, 2014,
Include active sites in the site selection.
Identify the type of equipment used.
In the auditing section - change early summer to August – September, change to 4 people per team, change all 2011's to 2014.
Make the logger aware we are auditing and invite to observe as opposed to asking permission.

There was a discussion on acceptable variation. Rutting and buffer zones were used as examples of how it was used in 2011. There appears to be agreement that there is a need for a “no harm no foul” option in the rating system.

Appendix B: Field Worksheet (includes list of BMP audit items and rating guide)

2014 FOREST SOIL AND WATER QUALITY REVIEW
FIELD WORKSHEET

DATE SITE REVIEWED:

CODE NUMBER:

SALE NAME:

AUDIT REGION:

AUDIT TEAM:

OWNERSHIP CLASS:

FEDERAL ☐

STATE ☐

CORPORATE ☐

NIPF ☐

CERTIFIED LANDOWNER:

YES ☐ NO ☐

If yes, what certification system?

RATING GUIDE

APPLICATION

A – BMP NEEDED, APPLIED CORRECTLY (as per guidelines)
V – BMP NEEDED, ACCEPTABLE VARIATION (differs from guidelines, no erosion or negative impact to water quality, soil productivity, or wetlands)
1 – BMP NEEDED, APPLIED INCORRECTLY (inadequate effectiveness)
2 – BMP NEEDED, NOT APPLIED (comment on severity of neglect)
NA – BMP NOT APPLICABLE (practice not needed)
0 - INSUFFICIENT INFORMATION TO RATE (minimal use if representative present)

General Direction for Completion and Interpretation of Rating Form:

1. Each auditor should rate each item on the below list. The team will then collaborate to develop a composite score.
2. There is no weighting of factors at this time.
3. Following completion of the composite form, all supplemental questions on the final page should be answered.
4. The rating system reflects the severity of non-conformance.
5. Comparisons between audit sites and between ownerships are difficult because of variability of time, site conditions, the many audited items, audit team membership, and other factors.
6. The audit report will indicate where weaknesses and strengths exist and where training is needed.

	RECOMMEND BEST MANAGEMENT PRACTICES	APPLIC-ATION RATING	COMMENTS
1	**Equipment Operation and Maintenance**		
1a	Located equipment adequate storage and maintenance sites outside buffer areas.		
1b	Provided for adequate storage and disposal of fuel, debris, lubricants, fluids and rinsate from equipment cleanup. (p 14)		
1c	Spills are cleaned up. If DEQ reporting threshold is met, then spill was reported. (p 14 &15)		
2	**Roads**		
2a	Avoided placing roads in RMZ or were placed at a minimum distance of 100' from the stream (p 31 & 34)		
2b	Excessive rutting avoided on the road: 6 inches deep and 25 foot long in RMZ, 12 inches deep and 50 feet long in other areas. (p 64)		
2c	Crown road on sections crossing level ground or low areas. (p 34)		
2d	Broad base dips installed properly. (p 45-47)		
2e	Water diversion ditches installed properly. (p 40-48)		
2f	Cross drainage culverts properly sized (min 12") and installed. (p 49 & 50)		
2g	Drain surface water into filter strip or vegetative draw. (p 47-49)		
2h	Energy dissipators at cross drainage and/or stream culvert outlets where necessary. (p 35)		
2i	Obstacles: avoid gullies, seeps, springs, wetlands, and poor drainage areas where possible. (p 31)		
2j	Roads out sloped where gradient permits. Where in-sloped (gradients 15%), adequate cross drainage is provided to protect water quality. (figure 4, p 36)		

2k	Road cuts sloped and stabilized to minimize water quality impacts. (p 35)		
2l	Roads follow contour with grades between 2% and 10%. Grades exceeding 10% do not exceed 300' in distance. (p 32)		
2 m	Soil erosion & sedimentation permit obtained for earth changes outside the sale area when 1 acre or more in size or if within 500 feet of stream. (p 93)		
2n	Regular road inspections performed and documented during and after harvesting (pg 38)		

3	**Road Closure and Retirement:**		
3a	Temporary cross drainage culverts and stream crossings removed. (p 38)		
3b	Water bars properly spaced and installed where slope of road requires and where temporary cross drainage culverts were removed. (p 40-44)		
3c	Erosion control features functional. (p 40)		
3d	Erodible soils stabilized by seeding, natural vegetation or brush. (pg 40)		
3e	Plantings utilize native seed species where possible, see Appendix E. (p 98-108)		
3f	Properly close and/or sign abandoned or infrequently used roads. (p 39)		
4	**Stream Crossings (permanent & temporary)**		
4a	If NO stream crossings, skip to #5		*If skipping to #5, please comment with NA for each*
4b	Stream crossing permit obtained and followed. (p 8)		
4c	Cross streams at right angles. (p 21 & 67)		
4d	Natural stream channel disturbance minimized. (p 54-55)		

4e	Stream bank approaches properly designed. (p 54-55)		
4f	Crossings do not impede fish migration. (p 54 & 59)		
4g	Culverts properly sized and installed. (p 57-58)		
4h	Culverts properly armored if needed. (p 56)		
4i	Sediment not being discharged into stream. (p 63)		
4j	Stream crossings follow contour with grades between 2% and 10%. Grades exceeding 10% do not exceed 300' in distance. (p 32)		
4k	Crown road on sections crossing level ground or low areas. (p 34)		
4l	Broad base dips installed properly. (p 41,45-47)		
4 m	Water diversion ditches installed properly. (p 41, 40-48)		
4n	Cross drainage culverts properly sized (min 12") and installed. (p 49 & 50)		
4o	Drain surface water into filter strip or vegetative draw. (p 47-49)		
4p	Energy dissipators at cross drainage and/or stream culvert outlets where necessary. (p 35)		
4q	Obstacles: avoid gullies, seeps, springs, wetlands, and poor drainage areas where possible. (p 31)		
4r	Temporary water crossings satisfactorily removed at termination of harvest activity. (p 52 & 54)		
5	**Skidding & Skid Trails**		
5a	Gradients no steeper than 40%, average slopes no more than 15%. (p 67)		
5b	Water bars properly installed as needed. (p 40 & 42)		

5c	Drain surface water into buffer strip or vegetative draw with energy dissipators as needed. (p 67)		
5d	Gullies, seeps and other permanently wet areas avoided where feasible. (pg 68)		
5e	Zigzag pattern – break grade to avoid long slopes. (p 67)		
5f	Excessive rutting avoided: 6 inches deep and 25 foot long in RMZ, 12 inches deep and 50 feet long in other areas. (pg 64)		
5g	Stream crossing permit obtained if skidding across stream. (pg 67)		
5h	Rehabilitate skid trails as needed. (p 68)		
6	**Landings and/or Decking Areas**		
6a	Located outside RMZ (p 65)		
6b	Provide for adequate drainage. (pg 65)		
6c	Proper water diversion devices in working order. (pg 65)		
6d	Drain surface water into buffer strip or vegetation and logging residue does not enter water bodies. (pg 65)		
6e	Erosion control features functional, no movement of soil from the landing area. (pg 64)		
6f	Re-vegetated/stabilized/leveled as needed		

7	Riparian Management Zones pgs 18-30		
7a	Is RMZ next to a designated State Natural River or Wild and Scenic River?		
7b	State Natural River Plan or Wild and Scenic River Plan followed and permit obtained. (p 26-28)		
7c	Buffer strip clearly established. (p 20)		
7d	Minimum width >=100 ft. (pgs 20, 22-23) Is there a designated trout stream less than 50 feet in width and appropriate widening of the RMZ (p 24 & 25)		
7e	Leave 60-80 BA and less than 10% of soil exposed within strip for shade tolerant spp. (p 20)		
7f	Leave 20-25 BA or ¼ to ½ acre clearcut patches and less than 10% of soil exposed within the RMZ, for shade intolerant spp. (p 26)		
7g	Leave late successional trees in RMZ		
7h	Retained sufficient cover to maintain shading of the stream to avoid increase in stream temp. (p 20)		
7i	No logging slash/debris disposed from outside of strip into strip. (p 21)		
7j	Excessive rutting avoided: 6 inches deep and 25 foot long in RMZ, 12 inches deep and 50 feet long in other areas. (p 64)		
7k	Streams, lakes, open-water wetlands free of slash. (p 20 - 21)		
7l	Located roads, landings and skid trails outside strip where possible. (p 21)		
7m	Cuts, fills, roads stabilized if present. (pg 21)		
7n	Limbs and tops within RMZ left on ground. (p 21)		
7o	Vernal ponds protected from rutting and buffered. (p 29)		
7p	Soil compaction and scarification avoided. (p 21)		

8	**Wetlands pgs 69-75**		
8a	If no wetland crossing skip to #9		*If skipping to #9, please comment with NA for each*
8b	Non-forestry construction does not occur without a Part 303 permit from DEQ. (p 69)		
8c	Permit obtained for culverts, bridges, or construction in floodplains > 2 sq miles. (p 10)		
8d	Excessive rutting avoided: > 6 inches deep and 25 feet long. (p 64)		
8e	Wetland crossings include placement of culverts and other structures to ensure adequate water flow and drainage. (p 70-74)		
9	**Other Considerations**		
9a	Archeological sites are protected if known to be present. (p 11)		
9b	Rare, threatened, and endangered species are protected if present. (p 12)		
9c	Site preparation and reforestation practices minimize soil disturbance, follow land contours, recognize RMZs, and avoid soil erosion. (p 78-82)		
9d	Harvesting is timed for appropriate conditions and operations minimize rutting and compaction damage. (p 70)		

SUPPLEMENTAL QUESTIONS

1. Did they implement all appropriate BMPs to control erosion (a system of BMPs)?
   Yes No

2. Did the system of BMPs control erosion & sedimentation?
   Yes No

3. What things went right on this site? (Summarize highlights)

4. What things went wrong in this site? (Summarize problems)

5. Have other activities occurred on this site that potentially impact water quality? (ie ATV use, hunting traffic, grazing, etc.) If so, please explain.

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

7. Give this site an overall rating considering application of BMPs with impact to water quality (Meets Expectations, Does Not Meet Expectations, Exceeds Expectations)

8. Rate this site for its overall impact to water quality (Severe, Moderate, Slight, Negligible, or No Impact):

9. Training needs identified:

Appendix C: Site Selection Spreadsheet: (*Close to 140 sites were submitted for consideration.)*

Forest Soil and Water Quality Audit Site Selection Spreadsheet (Final 7/8/14)

Ownership	Legal Description	County	Sale Name	Contract #	Expected Harvest Completion Date	Harvest Acreage	Harvest Equipment	Written Mgmt. Plan	Harvest Season	Drivable Summer Access	Water Body*	Stream Crossing**	RMZ	Wetlands Vernal Pools	Natural Wild Scenic River	Terrain steep rolling slight	Road Construc-tion	T&E Species	Archeo-logical Sites	Site Prep./ Reforest-ation	Forest of Exceptional Cons. Value
State							CTL		winter/frozen												
Federal							Tree Length		summer/dry												
NIPF							Other	(y/n/?)		(y/n/?)	(y/n/?)	(y/n/?)	(y/n/?)	(y/n/?)	(y/n/?)	?	(y/n/?)	(y/n/?)	(y/n/?)	(y/n/?)	(y/n/?)
Corporate																					
Tree Farm																					

Certified Landowner Yes or No (if yes, what system)

* Water body within sale area or adjacent to sale (RMZ present)

** Stream crossing either within the sale area or on road accessing the sale

The following criteria are being used to select site:

1. Timber sales harvested (and completed or nearly complete) between May, 2013 and September, 2014.
2. A body of water is located in or very near the sale.
3. Minimum sale size of 5 acres.
4. Site located no more than 1/2 mile from a road or trail accessible with a two wheel drive vehicle.
5. Sale with rolling or steep terrain, wetlands, riparian zones, road construction, and other types of buffer zones are preferred.
6. Location related to other sites will be considered.

Regions WUP: Marquette, Dickinson, Baraga, Iron, Houghton, Keweenaw, Gogebic, Ontonagon. Audit dates: August 27 & 28, September 3 & 4.

EUP: Menominee, Delta, Alger, Schoolcraft, Mackinac, Chippewa. Audit dates: August 18, 19, 26, 27.

NLP: Audit dates: September 24, 26 and October 1, 2.

Appendix D: Michigan SFI IC Participants and Partners, December 2014

Program Participants

- American Forest Management – Norway and South Range, MI
- Louisiana Pacific – Newberry and Sagola, MI
- Michigan Department of Natural Resources – Lansing, MI
- Molpus Timberlands Management, LLC – Houghton, MI
- NewPage Corporation – Escanaba, MI
- Packaging Corporation of America – Filer City, MI
- Plum Creek Timber Company – Escanaba, MI
- Sappi Fine Paper – Cloquet, MN
- Timber Products of Michigan – Munising, MI
- Verso Paper – Norway, MI
- Weyerhaeuser – Grayling, MI

Program Partners

- Great Lakes Regional Michigan Master Logger Certification Program – Crystal Falls, MI
- Greening of Detroit – Detroit, MI
- Michigan Association of Timbermen – Newberry, MI
- Michigan Technological University – Houghton, MI
- Michigan Tree Farm Committee – Lansing, MI
- Rob Nickels – Norway, MI
- Tony Fox, Bisballe Forest Products – Lake City, MI
- Warren Suchovsky – Stephenson, MI

Appendix E: 2014 Audit Team Members

Northern L.P.
Jessica Kernohan (Team Leader)
Senior Forestry Services Specialist
Weyerhaeuser

Scott Robbins
Director of SFI and Public Affairs
Michigan Forest Products Council

Roxanne Merrick
Environmental Quality Analyst
MI DEQ

Patrick Potter
Site Condition Forester
MI DNR Forest Management Division

Eastern U.P.
Andy Hayhoe (Team Leader)
Procurement Forester
PCA

Mitch Koetje
Environmental Quality Analyst
MI DEQ

Jennifer Burnham
Site Condition Forester
MI DNR Forest Management Division

Warren Suchovsky (2 days)
Qualified Logging Professional

Western U.P.
Howard Lindberg (Team Leader)
Senior Resource Forester
Plum Creek

Mark Korkko
Property Manager
Molpus

Lindsey Ringuette
Environmental Quality Analyst
MI DEQ

Amy Amman
Forest Soil Scientist
Ottawa National Forest

Appendix F: Responses to Audit Field Worksheet Supplemental Questions

3. What things went right on this site? (Summarize highlights)

Multiple sale administrators inspecting this sale; good use of turnouts to get water off road; culvert/cross drain installation looks good; appropriate plan for road closure work.

Road accessing sale area is in good shape; good RMZ (flagged and no operations within).

No activity in RMZ; 2 permits obtained for stream crossings; rotating harvest inspectors; good close-out plan for sale closure process; no evidence of spills in sale area.

Existing road required minimal pre-harvest maintenance and is presently in good condition; installation of temporary bridge was in compliance and minimal disturbance observed; no logging slash or debris in streams.

Minimal rutting due to properly armored trails; temporary winter crossing (stringers and snowpack during operations; stringers removed since) looked great with natural vegetation; very little soil disturbance.

RMZs established on ephemeral streams were not required but were implemented; road system improved since sale occurred; good efforts on erosion control; good protection of stick nest; marking within RMZ by forester; good stabilization of approaches on permitted crossing; well prepared sale administration and preparation for audit.

Road condition; crown present on road; leadouts abundant and functioning well; landowner is being proactive regarding invasive plant species control.

Skid trails not rutted and look to be in pretty good shape, especially considering terrain in the sale area; good buffering of the lakes; avoidance of operations on steep slope.

Good use of water turnouts; no harvest in SMZ; gate for road closure; wetland protected by PU boundary.

Skid trails in very good shape; good buffer along river, especially in clearcut area; soil map provided; documented harvest inspections were thorough; good planning/layout regarding SMZ areas; removal of metal garbage in sale area.

Water bars on skid trails and landings are in place on slopes and landings as needed; armored skid trails in sensitive areas as needed; roads crowned and ditched and appear stable.

Several cross drains installed; road is crowned; lead-outs that are in place are good, as well as diversion ditches; vernal pool not harvested.

USFS staff on site and were interested in suggestions and observations of audit team. Good RMZ, no ruts on skid trails, horizontal placement of slash, use of existing roads, good time of year, minimal in-woods impacts. This site is scheduled for post treatment road work and BMP will be applied where needed. Cut and fill work on slopes will only make erosion worse.

Effective RMZ, blocked road where moved, painted RMZ line, added gravel to some parts of road where needed; in woods operations show minimal impact.

Adequate RMZ no timber to cut in it; flat ground culverts already in place from previous sales; very low impact.

Blocked road with gate, good road and skid locations, road seeding in on own, put culvert in drive area for cross drainage, no major ruts (in the woods), time of year cutting worked.

Winter harvest and frozen roads were very well done, sale timing- conditions perfect, mineral soil left undisturbed in wetlands.

Low impact and good RMZ, even though road went through RMZ it was kept narrow, didn't scrape down to allow for soil movement.

Good RMZ /adequate, sandy soil and good summer timing, good road system already in place and used again.

Very little site disturbance, effective RMZ; didn't cut into the vegetative layer on skid road allowing for no soil disturbance.

Skid trail, assuming harvest timing allowed for natural regeneration to stabilize, no evidence of rutting or damage to floodway function, got permit, road stayed good.

Given the massive scale of the harvest we would have expected more BMP issues. A good haul road, timing, and supervision of the job. Built up road with gravel and filled holes, protected RMZ. Good RMZ establishment and management within the RMZ. Good road maintenance; good work maintaining existing road; and replacement of old culverts.

Great temporary bridge crossing of a large river (rapid); great timber bridge installation; temp bridge was placed and removed two times with no evidence of damage to banks observed; didn't get excessive with corduroy fill; seeded approaches; timing and method of operations minimized disturbance; protected stream and banks.

Good timing, bridge still in great shape, nice crown on road, well managed RMZ, excellent job of maintaining existing infrastructure, past practice could have improved turtle habitat, used correct herbicide to minimize amount needed for site prep operation, use of slash in skid trails to minimize rutting.

Utilizing existing road system, crane mats used to cross wetland, pulling out during spring thaw.

Well planned harvest for winter frozen conditions, used existing roads and trails.

Well planned for winter harvest to minimize site soil damage/compaction.

Time of year harvested, landing location, RMZ to Muskegon River.

Good access, used existing stream crossing.

Able to meet landowners objectives, crane mats utilized to protect existing wetland crossing, erosion was controlled.

Landowner objectives met, gravel put on county road at haul road access point, excellent aspen regeneration at site, no rutting.

No soil erosion or impact to wetland areas; used existing roads and great natural regeneration of the stand.

Logged in summer using existing roads in a high recreation area. Good planning and a positive example of thinning in RMZ.

Little to no environmental impact, RMZs were well marked, no damage to residual stand. Overall good planning with landing near road and minimized wetland crossing.

Logged in late spring to avoid wet weather; utilized crane mats. Overall awareness of resource by DNR staff given when lowland was discovered there was discussion on how to handle crossing appropriately.

Well planned out harvest, DEQ permit, utilized winter harvest conditions.

4. What things went wrong in this site? (Summarize problems)

Excessive rutting on skid trail (as previously mentioned); oil/lubricant spills not cleaned up per DNR contract requirements.

Very excessive rutting on skid trails with no rehabilitation efforts or plans to rehabilitate; operations on steep slopes; erosion on skid trails due to seeps, long steep grades, and lack of rehabilitation.

No waterbar/erosion control placement (lack of stabilization) at temporary bridge site during delay of activities (contract extension); lack of armoring on 2 permitted culverts; evidence of sedimentation in stream at culvert; ditches on road not stabilized; perched culvert.

Basal area in RMZ could be improved, as it was near threshold of acceptable; excessive rutting (un-remediated).

No permit at crossing, but good results/outcome on the ground.

Exposed soil and soil gouging/piling on skid trail within RMZ, lacking erosion control measures (waterbar, slash, seeding). No noted impacts to water quality. Soil movement on road with sediment leading directly to small stream/cross drain. Ruts in road near gate.

Pushing fill material and debris into forested wetland (impacts negligible).

Undersized culvert on crossing that should have been permitted, silt fence installed improperly and not functioning.

Some washing/soil & gravel movement on Old Hwy 141; sediment and pea gravel in stream channel.

Several plugged and/or damaged cross drain culverts; contaminated soil area near storage trailer; perched cross drain culverts.

Several cross drains installed; road is crowned; lead-outs that are in place are good, as well as diversion ditches; vernal pool not harvested.

No water issues in woods; surface water run off requires BMP work on the roads, needs a variety of practices, need to consider safety as well as erosion control. Erosion will probably not reach surface water but will keep damaging road bed. Private landowners "helping" fix the road. 2 roads with steep gradients did not have any BMP to control runoff.

Need broad base dips in some areas, lack of crown adding to sediment movement on main haul road, could use some practices to slow down the movement of water.

Utilization could have been better.

Poor haul road construction, no crown on road, berms created because of this, dirt/rocks pushed into the edge of woods off road (soil into "wetlands") snow free harvesting to see where previous ditches to the road were so they were fixed and used again.

Nothing – *5 responses.*

None – *6 responses.*

Road slash and berm not adequate to stop ATV use.

A couple of spots needed diversion ditches to prevent more sediment movement. At stream crossings that did not get replaced; the road had berms on the sides and appropriate BMPs were

not in place to prevent sediment discharge to the stream; could use some diversions and broad base dips on some crossings.

Regeneration issues because of deer browse.

Logger cut a little heavy in RMZ; not excessive.

Wetlands crossing utilized for logging purposes increased landowner access across wetland.

Slash and stumps pushed over hillside in RMZ.

Sudden weather change, spring thaw with quick snow melt caused rutting throughout the timber sale.

OFI - Wetland area should be indicated as such on the timber sale map, not listed as an excluded area of the sale.

Corduroy did not rise to the level of corrective action; much discussion took place in regard to removing corduroy from the wetland crossing at sale completion.

5. **Have other activities occurred on this site that potentially impact water quality? (ie ATV use, hunting traffic, grazing, etc.) If so, please explain.**

No – *3 responses*

Water bars were not constructed due to public access and concerns for failure of water bars and later erosion issues.

Road is open and is access for other easement/access holders; other landowners/access owners may be doing maintenance on the road; evidence of vehicular traffic through stream at temporary bridge site.

Yes – ATV use (crossing through stream).

Yes – ATV traffic through streams where culverts were removed (stringers placed (by ATV users) in stream at crossing on permitted stream); ATV use on road.

Mountain Bike/Hike trails in RMZ area could have impacts, though none were noted.

Private land, but road is not physically closed, so likely gets used.

Some traffic to river and deer camps as road remains open.

Truck and ATV traffic on Peshekee Grade.

Road is a private, gated road; DNR has requested road remains open (has easement from a different direction/route).

Recreational use and private ownership inholdings; untrained inholding owners working on the road; heavy ATV use.

Local ORV traffic.

Saw moose tracks.

Hunting blind, ATV tracks.

No, blocked roads well enough to keep ATV's from entering sale area (tracks noticed where turned around).

Camp north of timber sale that uses the road that goes through RMZ.

Snowmobile trail, traffic, ATVs and hunting – some errosion occuring at the bridge site.

Local through traffic; ATVs.

Possible surface damage unlikely to impact surface water; hunting and ATV use.

Area not blocked to the public, potential ATV and hunter traffic.

Hunting, traffic (reason for removal).

Hunting, fishing, ATV's.

None – *6 responses.*

No Impact – *2 responses.*

Landowner wetland access and use.

Existing roads and trails used for ATV, hiking, horses, camping, etc.
Not yet, ATV presence/pressure increasing in the area.

Horse traffic on recreational trail prior to timber sale, stream crossing mitigated this damage and trail/crossing was closed off.

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

Plans for road closure work, including temporary bridge removal, culvert removal, rehabilitation of rutted skid trail, installation of water bars and broad based dips as needed. Bond is in place to ensure work is completed satisfactorily.

Recommend rehabilitation/remediation of skid trails (leveling and stabilization); consider additional water diversion ditches; recommend installation of water bars on slope on main access road.

Stabilize temporary bridge site or install temporary bridge; additional ditching/lead outs constructed; issues should be addressed by the time the sale is closed out.

No – (see rutting comments in worksheet).

No. Not Applicable.

Recommend additional seeding in ditch at check-dam.

Recommend installation of cross drain culvert above existing cross drain culvert.

Recommend installation of waterbars on old road on steep slope to ensure stability.

Yes – Silt fence maintenance and correction, maintenance of cross drains/stream crossing, approaches will be receiving corrective action.

Road maintenance is already on the schedule to repair washing/erosion.

Plans in place for maintenance and closure of sale.

Better establish ditching and turnouts near wetland and cross-drain culverts.

Need to apply several practices. USFS staff well aware of issue and appear to be in early planning stage; sale not complete, will work with loggers to fix 2 roads; USFS will work on issues not covered with timber sale contract.

Future road work would include more BMP work; should add diversion ditches to haul road.

None seen.

Extra dirt (spoils) on the side of the road needs to be put back into the road with the tops dispersed; add crown to the road and get rid of berms on the edges of the road.

Not at this time.

Try to get road moved out of the RMZ.

Make sure road closures take place after completion of timber sale.

Bridge and culvert will need to be improved because of the abutments getting stressed and the culvert size.

Fix berm.

None needed.

Will replant to red pine and continue to improve roads. Yes, see #4, owner said they identified this as an issue and will address it. In planning process- mitigating factors should be done during the sale and maintained after the sale is completed- not just after.

None - *8 responses.*

No - *2 responses.*

If Landowner carries out anymore road improvement or building within the wetland, they should contact the DEQ, no logging exemption for this activity, potential regulatory issues.

Wetland crossing - culvert is going to be replaced/upgraded to better fit circumstances.

No, should corduroy materials be removed from wetland crossing? This issue does not require corrective action at this time.

7. Give this site an overall rating considering application of BMPs with impact to water quality (Meets Expectations, Does Not Meet Expectations, Exceeds Expectations)

Exceeds expectations – *3 responses.*

Meets expectations – *30 responses.*

Does not meet expectations – *3 responses.*

8. Rate this site for its overall impact to water quality (Severe, Moderate, Slight, Negligible, or No Impact):

No Impact – *16 responses.*

Negligible – *11 responses*.

Slight – *8 responses*.

Moderate – *1 response*.

9. Training needs identified:

Awareness of spills; DEQ clarification on allowable quantities/thresholds for spills.

Skid trail remediation.

Permit timelines.

None – *4 responses.*

Permitting requirements and info. on new BMP regulations (bankfull training).

Consider permanent crossings.

Awareness regarding sustainable trail development (mountain biking and hiking); cross drain installation.

SFI certification CE's.

Refresher on RMZ buffers.

Improved understanding of permitting requirements (BMPs and permitted crossings; culvert sizing, new rules for bankful permitting (BMPs need to be updated in manual).

Maintenance of culverts; some culverts need improvements; cleanup of spills (policy).

Inform road contractors about over-working wetland/cross-drain areas.

Road BMP installation, USFS needs to identify their strengths and weaknesses of the process/procedure with regards to infrastructure associated with timber sale administration, area within the sale is good- just the roads, when is a permit required.

Cost of doing good road improvements now to save time/money down the road, seems there are too many people involved and not enough overall knowledge of what is happening on the ground.

Not really - easy site to harvest.

Tops put under equipment when going through low areas, road grading, diversion ditches where and how, spoil placement.

No – good area to show others how to harvest in low, wet ground.

None at this time.

Alternatives to culverts to cross drainways.

Continue training when wetland and stream crossings permits are needed. Proper stream crossing replacement measures; update and changes to requirements.

None, very experienced, just periodic updates as new requirements come along.

Stream and wetland identification in questionable situations, good communication with loggers.

Yes, Landowner education.

Don’t let landowners talk you into doing something that is not good.

Rutting: consequences, avoidance, and mitigation.

None identified.

RMZ awareness in questionable areas.

Great example of a well-planned site.

Does the use of corduroy need to be addressed?

Removal of corduroy/slash at the sale of completion from wetland crossing areas. Importance of crossing in lowland areas given they are potential headwaters for many of lakes and streams.