



MICHIGAN FORESTRY BEST MANAGEMENT PRACTICES

2016 MONITORING STUDY RESULTS

REGION 2 (EASTERN UPPER PENINSULA)

AND

REGION 3 (LOWER PENINSULA)

AND

STATEWIDE SUMMARY RESULTS



Prepared by:



February 2017

MICHIGAN FORESTRY BEST MANAGEMENT PRACTICES

2016 MONITORING STUDY RESULTS
REGIONS 2 AND 3
AND
STATEWIDE SUMMARY RESULTS

Client:

Michigan Forest Products Council Foundation



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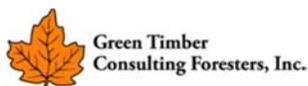
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Effective Date: February 28, 2017

Best Management Practices Statewide Monitoring Report

Project	Michigan Best Management Practice (BMP) Guideline Monitoring
Location	Michigan – All Regions (Upper and Lower Michigan)
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1. BMP Background

1.1 MI BMP Area

Michigan (MI) Best Management Practices (BMPs) are voluntary, generally accepted guidelines recommended for implementation to protect water quality and soil integrity. They apply to forestry-related activities, primarily commercial forest harvesting operations. The latest version of the Michigan BMP Manual was revised in 2009. This document can be found on the Michigan DNR website at:

http://www.michigan.gov/documents/dnr/IC4011_SustainableSoilAndWaterQualityPracticesOnForestLand_268417_7.pdf. Further explanation of MI BMPs can be found in Exhibit 2. This exhibit contains the introduction to MI BMPs, written by Dr. Larry Pedersen, which was included in the 2015 Michigan BMP Monitoring Study report, in addition to both the 2011 and 2014 BMP Sustainable Forestry Initiative (SFI) reports.

1.2 Project Overview – Study Area

In an effort to determine implementation of BMPs in the State of Michigan, the Michigan Forest Products Council Foundation (MFPCF), with support and funding issued by the State of Michigan and the Michigan Department of Agriculture and Rural Development, issued a request for a proposal to complete the second phase of statewide forestry BMP analysis. Previous efforts occurred in 2015 to evaluate BMP implementation in Region 1 (Western Upper Peninsula), which required the development of a monitoring system to analyze the application of BMPs for water quality and related forest ecosystems occurring on managed forestlands. The most recent 2016 efforts included evaluation of the remaining portions of the state, Region 2 (Eastern Upper Peninsula), and Region 3 (Lower Peninsula). A geographic breakout of the regions is provided in Figure 1.

Similar BMP monitoring occurred in 2011 and 2014, and was organized and executed by the Michigan SFI Implementation Committee in conjunction with the Michigan Departments of Natural Resources and Environmental Quality. The 2015 and 2016 BMP monitoring project layout, field monitoring methods, and report analyses are similar to previous BMP monitoring efforts, but included improvements in sample size, statistical validity, and consistency of methods.

Steigerwaldt Land Services, Inc. (Steigerwaldt), a forestry and real estate consulting company with offices in Tomahawk and Hayward, Wisconsin, Marquette, Michigan, and Chilllicothe, Ohio, was selected to design and accomplish BMP monitoring in 2015 and 2016. Steigerwaldt partnered with Green Timber Consulting Foresters, Inc. (Green Timber), located in Pelkie, Michigan, for both 2015 and 2016 monitoring seasons. In addition, Martell Forestry, Inc. (Martell), located in Gaylord, Michigan, contributed to the 2016 monitoring efforts. Both Green Timber and Martell offered significant assistance in project coordination, local expertise, and site monitoring.

Figure 1 - Monitoring Region and Year of Field Work



The two-year project was overseen by a group including Steve Shine, Ben Schram, Larry Pedersen, Charlie Becker, Scott Robbins, and Robert O’Meara (2015), referred to as the oversight committee. The oversight committee’s observations and takeaways are summarized in Exhibit 1, found at the end of this report.

1.3 Project Scope

In July of 2015, a “project start up” conference call was initiated by Steigerwaldt, and included Green Timber staff, MFPCF representatives, and additional project cooperators involved with previous MI BMP monitoring

efforts. During this meeting, project details were discussed, and benchmarks and goals were established to successfully complete the project.

Considering the 2016 effort was an extension of the 2015 project, detailed project targets were similarly established in 2016. Landowner permission was to be secured in a timely fashion so that all fieldwork would be completed by November 30, 2016, with the report of results due by the end of February 2017.

In response to recommendations provided in the 2014 report, a larger sample size of 100 sites was set for the 2015 monitoring effort. The sample size of 100 sites per region was applied to Regions 2 and 3, resulting in a total of 300 sites statewide. Further explanation of the entire site selection process is provided in the Methods Section 2.1.

Following the site selection process, a training date was established for all project cooperators conducting timber sale inspections. Monitoring teams were comprised of three members, including two Steigerwaldt, Green Timber, and/or Martell staff, and one project cooperator. Project cooperators were included to create a balanced team that provided local expertise and a professional opinion from a third party.

Steigerwaldt staff members worked with members of the oversight committee to select project cooperators who consisted of agency representatives from the regional Forestry Assistance Program (FAP). In 2015, other professional employees from the state forest and United States Forest Service (USFS) were asked to participate, but their schedules did not allow them to be involved in the BMP monitoring project. A list of the monitoring team cooperators from 2015 and 2016 are provided in Exhibit 3.

During field monitoring efforts, landowners were invited to attend the site inspections, but were not required to be present. All 200 sites selected for Regions 2 and 3 were visited by members of the monitoring teams from September 30 through October 18, 2016. Project cooperators were contacted to attend a majority of the site inspections; however, there were instances when only Steigerwaldt, Green Timber, and/or Martell staff were available. These exceptions allowed us to meet the site monitoring project deadlines.

2. Methods

2.1 Site Selection

The site selection survey required an analysis to determine a statistically significant sample size. Per the recommendations of previous MI BMP inspections, the study sample size was designed following the methods outlined in the "*Silvicultural Best Management Practices Implementation Monitoring - A Framework for State Forestry Agencies*" (Southern Group of State Foresters (SGSF) Water Resources Committee, 2007). This method assumes 95 percent confidence around the percent implementation rate. The following formula was used to determine the sample size:

$$n = \frac{4p(100 - p)}{m^2}$$

Where n = number of sites to evaluate
 p = estimated overall percent implementation
 m = margin of error

The following values were used in calculating the sample size for the 2016 study.

p = 95.5 percent implementation (overall percent of appropriately applied BMPs from 2015)
 m = 5 percent (as recommended by the SGSF framework)

The result of this analysis found " n " to equal 68. Therefore, at least 68 sites would be necessary to achieve implementation statistics within 95 percent probability for each region. For the 2016 study, we selected 100 sites for each region to stay consistent with the 2015 monitoring effort. Following the determination of the total sample size, sites were allocated by ownership group based on the average annual removals (harvests) on timberland acres, estimated from the USDA Forest Service's Forest Inventory and Analysis (FIA) database.

The FIA request occurred on May 19, 2016, and encompassed data from 2010 through 2015. The 100 sites per region were allocated within the following forestland ownership groups: federal, state/county, large private (corporate), and non-industrial private forestland owners (NIPF).

To differentiate FIA removals between large private landowners and smaller NIPF landowners, we requested custom data from the USFS Spatial Data Services group. Steigerwaldt provided the USFS a geographic information system (GIS) layer of lands enrolled in the Michigan Commercial Forest (CF) and Qualified Forest (QF) programs within the study area owned by TIMO, REIT, or corporation ownership. This area was overlaid with the FIA plot grid to derive average removals from the large private forestland owner group. These figures were then subtracted from the gross private land FIA volumetric figures (FIA data from 2010 through 2015) to derive the NIPF statistics. The sample sites were then allocated across the ownership categories based on their proportion of the FIA-derived removals. The following figures display the ratios of total monitoring sites, removals, and timberland acres by ownership category (Figures 2 through 4).

Figure 2 – Monitoring Allocation Analysis, Region 1: Michigan’s Western Upper Peninsula (2015)

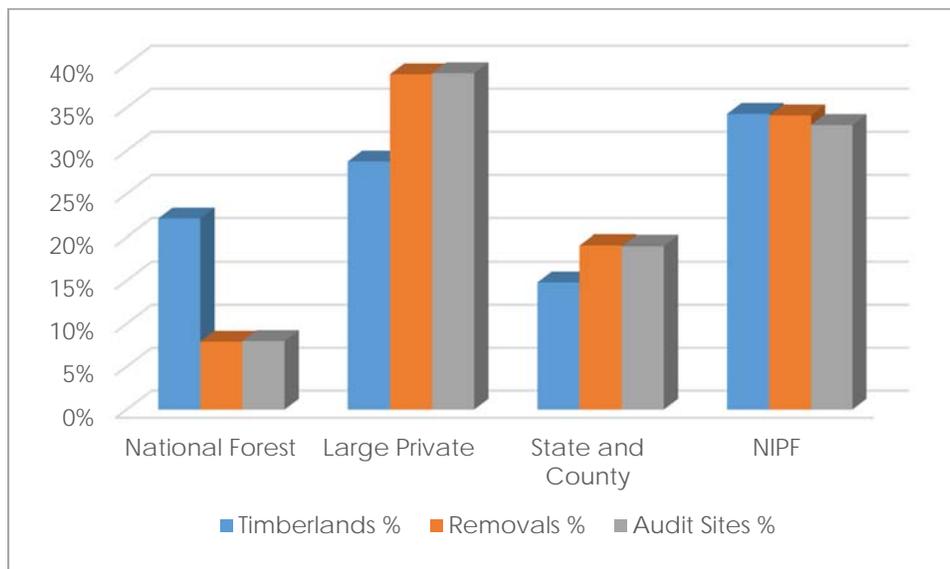
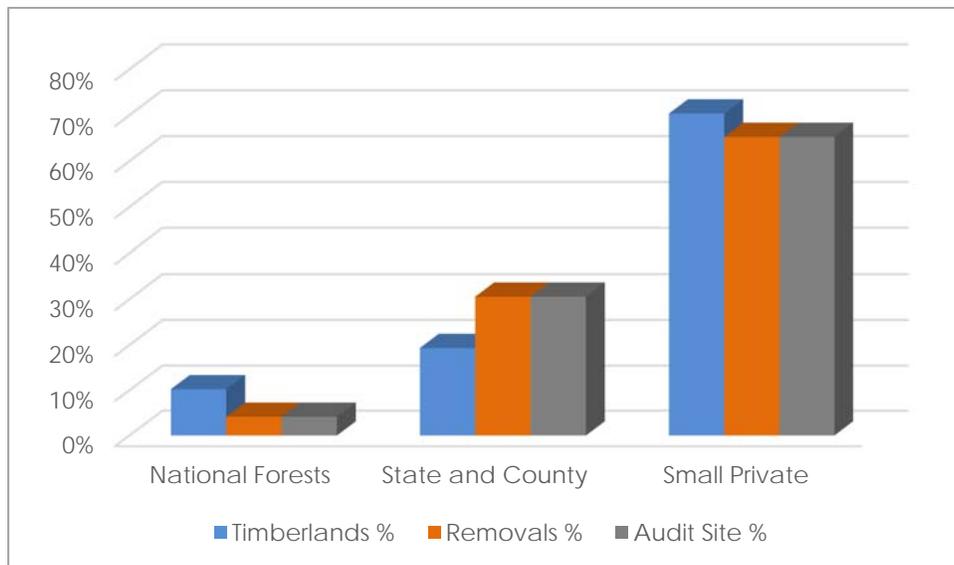


Figure 3 – Monitoring Allocation Analysis, Region 2: Michigan’s Eastern Upper Peninsula (2016)



Figure 4 – Monitoring Allocation Analysis, Region 3: Lower Michigan (2016)



2.1.1 Building the Initial Timber Sale Database

A database of potential timber sales was developed to support random selection methodology. Data was requested in various methods, and was presented in a manner that best suited the contact/landowner. Mill representatives, loggers, and public forest and corporate land managers were contacted by letter on June 1, 2016, while the NIPF owners were sent a letter on July 28, 2016 (refer to Exhibit 4 - Land Managers Data Request Letter and Exhibit 5 - Non-Industrial Private Forestland Owners Data Request Letter).

All timber sales greater than five acres that were completely harvested between May 1, 2014, and April 30, 2016, were requested during this phase. State/county, federal, and large private landowners were contacted directly during the initial data collection process. Sale data from NIPF lands was identified by requesting timber sale information from several of the larger mills, loggers, consulting firms, and the QF and CF programs. The information we received from the mills and loggers also included public land and large

private sales, many of which were previously received directly from the landowners or their agency representatives. Therefore, we cross-referenced these sales with the information received directly from the landowners to ensure duplicates did not occur.

The final sale selection process is discussed in Section 2.1.3.

2.1.2 Preliminary Selection and Landowner Contacts

To maintain confidentiality of participants, random numbers were applied to each sale. The sales were ordered smallest to largest using the random number sequence, and a preliminary filter was applied to narrow down the pool of eligible timber sales. The preliminary filter removed all sales less than five acres in size or that were reported as being currently active or not completed. Following this preliminary data filter, a pool of eligible timber sales was selected. Within each ownership group, roughly two times the requisite sample size were examined to ensure the sample goals were met for each landowner class. In a secondary request, we asked data contributors for timber sale maps, GIS layers, and permission to inspect lands for this study if they had not provided the information previously. We were able to request this information directly for large private, state/county, and federal lands via email. For NIPF sales provided by consultants or mills, we continued to request this information from these sources, and asked them to contact the landowners that they contributed to the study. In 2015, a second letter was sent reminding landowners of our original request, but due to the low success rate in acquiring permission to visit timber sales on NIPF lands during this secondary effort, only one mailing was sent in 2016. Obtaining our target number of NIPF sites required significantly more sites as it was the largest sample size and most difficult to acquire participation.

2.1.3 Final Sale Selection

Once the secondary timber sale information was received, the final sale selection was made. The basis of the final selection occurred at the quarter-quarter description in which the sale occurred. Quarter-quarter descriptions were used since maps or GIS layers were not available for some sites. To keep the final selection process consistent between all ownership types, the quarter-quarter descriptions in which each timber sale occurred were used in the GIS analysis. Using open-source GIS data, the timber sale quarter-quarter descriptions were overlaid with transportation and water feature layers during the final selection process. Sales meeting the following criteria were eligible for the study: a mapped water feature (lake, river, stream, or wetlands) occurring within the quarter-quarter descriptions and a road accessible by a two-wheel drive vehicle occurring within one-quarter mile of the quarter-quarter description. Sales that met this criteria were selected following their assigned random number ordering, starting with the smallest number and proceeding in ascending order. The selection methodology was consistent for both study years.

Table 1 provides a summary of the final sample allocation by ownership group. The sampling approach successfully achieved optimal allocation ratios, as evidenced by the FIA data analysis in Section 2.1.

Table 1 – Final Site Allocation by Owner and Region

Sites Per Ownership and Region				
Ownership	All Regions	Region 1 Western UP	Region 2 Eastern UP	Region 3 Lower Peninsula
Large Private	59	39	20	0
Small Private (Non-Industrial Private Forests)	137	33	39	65
State/County	86	19	37	30
National Forest	17	8	4	5
Total	299	99	100	100

A summary of the timber sale criteria required for eligibility and site filtering is provided below.

2016 Site Requirements Summary

1. Active sales fully completed between May 1, 2014, and April 30, 2016
2. At least five acres in size
3. Sale has a mapped water feature (lake, river, stream, or wetlands) within one of the quarter-quarter descriptions the sale is located in
4. Must have a road accessible by two-wheel drive vehicle (all mapped roads in the MI base road layer) bisecting the selected quarter-quarter section(s) that the sale occurred within (GIS road layer sourced from the MI Department of Technology).

2.2 Site Monitoring and Rating Methodology

Timber sale site inspections commenced on September 15, 2016, with a training day occurring on a selected timber sale in Montmorency County (LP). The training day included a review of the project scope, site inspection forms, and monitoring processes that aided in calibrating the monitoring team. The BMP Monitoring Manual is provided as Exhibit 6.

Inspections were coordinated so all members of the monitoring team were on site evaluating as one group. Steigerwaldt adopted a rating process similar to that used in the 2014 BMP inspection efforts, but expanded upon the field worksheet previously developed. Additional details were measured and recorded for questions where specific measurement could prove useful. A copy of the field worksheet used for site inspection is provided as Exhibit 7.

During the 2015 project, Steigerwaldt developed a proprietary tablet-based data recording application to help streamline the data collection and review process. The application allowed the monitoring teams to efficiently record the final site ratings after agreement by the team, allowed for photos to be automatically linked to sites, and created efficiencies when analyzing the data. Electronic data entry and storage also provides data security and data quality benefits. This same technology was used for the collection of all 2016 site data.

The application of the rating methodology was thoroughly evaluated during the project design. Consistent scoring and usage of the ratings were conveyed during the training exercises and reviewed during a final editing process upon completion of all site evaluations. Following the download of site inspection data, each BMP question was examined in an editing process, evaluating final results for errors, editing record errors, and ensuring consistency amongst responses in the monitoring database. When errors could not be easily resolved in post editing by the analysis team, the field team leaders were asked to assist in evaluating the question.

The site monitoring rating definitions are provided below, and are the same as used in the 2015 BMP monitoring project (Table 2).

Table 2 – Inspection Rating Guide

Code	Rating Description
A	BMP needed and 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)

Details on the application and use of the ratings during field monitoring are provided in the following paragraphs and are referenced in Exhibit 6.

A – BMP Needed and Applied Correctly

This rating signifies that the BMP described in a specific question is needed, and that the BMP was implemented as the BMP guidelines instruct. Also, the implementation of this BMP is properly working and protecting environmental quality.

Example Pertaining to Question 4c: While monitoring the site you observe that a stream was crossed at a 90-degree angle as the BMP manual instructs, and the crossings had minimal impact on water quality.

V – BMP Needed, Acceptable Variation

Acceptable variation applies to BMPs that are needed on a site, but are not implemented to the BMP manual specifications. This rating was used for any performance measure where following the guidelines may have been difficult, or the site provided an opportunity to remedy water quality concerns in a non-conventional manner. No erosion or negative impact to water quality was observed during the inspection.

Example Pertaining to Question 4c: You notice that a crossing is not at a 90-degree angle, but appears to not be eroding or having a negative impact on water quality. The modification of the crossing may have best suited the site.

1 – BMP Needed, Applied Incorrectly (inadequate effectiveness)

This rating pertains to questions where a BMP is needed and applied, but was not done properly and is therefore not protecting environmental quality.

Example Pertaining to Question 4c: Crossing is at a 60-degree angle and is having a negative impact on water quality.

2 – BMP Needed, Not Applied

The not applied rating refers to situations where there is a negative impact on the environment due to timber harvesting and, if the appropriate BMP practice was implemented, the negative impact could have been prevented.

Example Pertaining to Question 4c: Stream crossed without a water crossing structure in place. Water quality has been impaired.

NA – BMP Not Applicable (practice not needed)

This rating is applied to all questions where BMP features or practices are not needed on the site.

Example Pertaining to Question 4c: No water crossings on site.

0 – Insufficient Information To Rate

The insufficient information rating refers to questions that the monitoring team was unable to accurately assess for BMP specifications. This rating is often recorded for questions relating to permits.

Example Pertaining to Question 4c: Monitoring team unable to tell if crossing(s) were used in accordance with guidelines or are having a negative effect on water quality.

3. Results and Discussion

3.1 Summary of Timber Sale Requests

As discussed in Section 2.1.1, several sources were contacted in an effort to collect timber sale information. Overall, responses were received from less than 35 percent of the contacted sources. The 2016 study received considerably more sales from mills and consultants than the 2015 study (Table 3).

Table 3 – 2016 Timber Sale Request Summary (Regions 2 and 3)

Request Summary				
Source	No. of Landowners Contacted	Received Data From	No. of Sales Received	Proportion of Sales Received (Percent)
Mills	14	5	343	9.9
Forest Service	2	2	86	2.5
MI DNR	1	1	2,105	60.6
County Forests	0	0	0	0.0
TIMOs/REITs	5	3	168	4.8
Loggers	27	4	19	0.5
Consultants	22	8	392	11.3
QF/CF Programs	2	2	360	10.4
Total	73	25	3,473	100.0

In the federal large private and state/county landowner classes, the majority of the sales came from the managing representative(s). The following table reports the origin of timber sales received by ownership class. Similar to the 2015 study, the NIPF ownership group was the most difficult from which to collect timber sale data and proved challenging in securing project cooperation. In 2016, we worked more closely with area consultants and procurement foresters to improve cooperation and secure better information on NIPF timber sales. For the 2016 study, 34 percent of the NIPF sales originated from the QF/CF programs, while 32 percent of sales came from consultants. This differs from the 2015 study where the QF/CF programs accounted for 70 percent of the NIPF sales and consultants accounted for 15 percent. The table below also shows that mills submitted sale data for purchased state timber sales. These entries resulted in duplicates in our database, since the majority of these sales were provided by the landowner representatives (Table 4).

Table 4 – 2016 Timber Sale Request Summary by Ownership (Regions 2 and 3)

Percent of Sales Submitted by Ownership				
Source	Federal	Large Private	State/County	NIPF
Mills	-	-	0.6	31.5
Forest Service	100.0	-	-	-
MI DNR	-	-	99.4	-
County Forests	-	-	-	-
TIMOs/REITs	-	75.9	-	0.1
Loggers	-	-	-	1.8
Consultants	-	24.1	-	32.3
QF/CF Programs	-	-	-	34.3
Total	100.0	100.0	100.0	100.0

3.2 Regions 2 and 3 Study Area Results

A total of 200 eligible timber sales were successfully visited and monitored during the 2016 study effort for Regions 2 and 3. When BMPs were deemed necessary, BMP guidelines were applied correctly 97.0 percent of the time in Region 2 and 96.1 percent in Region 3. Photo examples of BMP applications observed during the study can be found in Exhibit 10. These results represent an increase from the 2015 results when Applied Correctly (A) ratings occurred 95.5 percent of the time. Negative ratings were recorded for 1.3 percent of the needed BMP applications for Region 2 and 2.8 percent for Region 3, while, in 2015, they made up 2.4 percent of the ratings (Table 5).

Table 5 – 2016 Summary Results - Regions 2 and 3

Rating	Region 2		Region 3	
	No. of Observations	Percent of BMPs Needed	No. of Observations	Percent of BMPs Needed
BMP Applied Correctly (A)	2,622	97.0	2,284	96.1
BMP Acceptable Variation (V)	46	1.7	27	1.1
BMP Applied Incorrectly (1)	14	0.5	12	0.5
BMP Needed & Not Applied (2)	21	0.8	54	2.3
BMP Application Not Needed (NA)	4,711	-	5,039	-
Insufficient Information (0)	386	-	384	-
Total BMP Applications Needed	2,703	-	2,377	-
Total BMP Applications Assessed	7,800	-	7,800	-

A total of 81 possible BMP applications (questions) were included in the monitoring survey. The most commonly recorded rating was BMP Application Not Needed (NA), accounting for roughly 62 percent of the study observations (applications assessed on each timber sale) in Region 2 and 66 percent in Region 3. The 200 timber sales evaluated had at least one BMP application needed per sale. The average timber sale had 25 needed BMP applications. This is a decrease from the 2015 study of Region 1, where the average timber sale had 37 needed BMP applications. In the 2016 study, the maximum BMP applications on a timber sale was 58, while the minimum was 10.

Similar to that of the 2015 results, all categories, except for wetlands, had an Applied Correctly (A) rating frequency greater than 90 percent in both 2016 sample regions. The wetlands category was distinctly different in that it had the highest Applied Incorrectly (1) and Not Applied (2) rating frequency for Region 2 and the highest Not Applied (2) rating in Region 3. Wetlands also had the highest percentage of Acceptable Variation (V) in both regions. Region 3 had fewer ratings of Acceptable Variation (V) and Applied Incorrectly (1), but had a much higher rate of Not Applied (2). The remainder of the categories are consistent with what was found in previous surveys (Tables 6 and 7).

Table 6 – Region 2: Reporting by Rating and Application Category

Results by Category				
Category	Percent Applied Correctly (A)	Percent Acceptable Variation (V)	Percent Applied Incorrectly (1)	Percent Not Applied (2)
1. Equipment Operation and Maintenance	98.3	0.6	0.6	0.6
2. Roads	96.9	1.7	0.7	0.7
3. Road Closure and Retirement	97.6	0.4	0.4	1.6
4. Stream Crossing	96.6	0.0	3.4	0.0
5. Skidding and Skid Trails	95.8	1.7	1.0	1.5
6. Landing and/or Decking Areas	100.0	0.0	0.0	0.0
7. Riparian Management Zones	95.2	4.2	0.0	0.6
8. Wetlands	66.7	20.0	6.7	6.7
9. Other Considerations	97.4	1.5	0.5	0.5
Overall	97.0	1.7	0.5	0.8

Table 7 – Region 3: Reporting by Rating and Application Category

Results by Category				
Category	Percent Applied Correctly (A)	Percent Acceptable Variation (V)	Percent Applied Incorrectly (1)	Percent Not Applied (2)
1. Equipment Operation and Maintenance	100.0	0.0	0.0	0.0
2. Roads	94.9	1.7	1.0	2.5
3. Road Closure and Retirement	92.2	1.2	0.8	5.8
4. Stream Crossing	91.4	0.0	0.0	8.6
5. Skidding and Skid Trails	96.4	0.4	0.4	2.8
6. Landing and/or Decking Areas	99.3	0.0	0.2	0.4
7. Riparian Management Zones	94.5	4.7	0.4	0.4
8. Wetlands	72.2	5.6	0.0	22.2
9. Other Considerations	97.8	0.6	0.6	1.1
Overall	96.1	1.1	0.5	2.3

As found in the 2015 study, the wetlands and stream crossing BMPs were needed the least when compared to the other categories within Regions 2 and 3. In 2015, the wetland and stream crossing categories needed slightly higher percentages, with stream crossing BMPs being needed 14.5 percent of the time and wetland BMPs being needed 10.9 percent of the time. The number of times BMPs were needed appears to be similar between each region in the 2016 study, with the exception of Riparian Management Zones (RMZ), where Region 2 needed over 200 times more than Region 3. In the 2015 study of Region 1, RMZ BMPs were found to be needed more often than in the regions studied in 2016, with Region 1 requiring RMZs 50 percent of the time (2015). This compares to the 2016 efforts where RMZs were required 29.9 percent of the time in Region 2 and 14.8 percent in Region 3. Both Regions 2 and 3 had a lower percent of BMPs needed in almost every category when compared to Region 1 (2015). The different frequency of needed BMPs strongly suggests a difference of water quality risk in sales located in the Western Upper Peninsula compared to those in the Lower Peninsula and Eastern Upper Peninsula (Tables 8 and 9).

Table 8 – Region 2: Needed and Total Possible Observations by BMP Category

Observations by BMP Category			
Category	No. of Times BMP Was Needed	Total Possible Ratings	Percent BMP Needed
1. Equipment Operation and Maintenance	176	400	44.0
2. Roads	575	1,400	41.1
3. Road Closure and Retirement	247	600	41.2
4. Stream Crossing	29	1,600	1.8
5. Skidding and Skid Trails	478	800	59.8
6. Landing and/or Decking Areas	510	600	85.0
7. Riparian Management Zones	479	1,600	29.9
8. Wetlands	15	400	3.8
9. Other Considerations	194	400	48.5
Overall	2,703	7,800	34.7

Table 9 – Region 3: Needed and Total Possible Observations by BMP Category

Observations by BMP Category			
Category	No. of Times BMP Was Needed	Total Possible Ratings	Percent BMP Needed
1. Equipment Operation and Maintenance	173	400	43.3
2. Roads	525	1,400	37.5
3. Road Closure and Retirement	257	600	42.8
4. Stream Crossing	35	1,600	2.2
5. Skidding and Skid Trails	500	800	62.5
6. Landing and/or Decking Areas	453	600	75.5
7. Riparian Management Zones	236	1,606	14.8
8. Wetlands	18	400	4.5
9. Other Considerations	180	400	45.0
Overall	2,377	7,806	30.5

3.2.1 Review of BMP Application Questions

BMP performance is documented in Exhibit 8, which provides summaries outlining the best and poorest performing questions. The tables in this exhibit also highlight questions that had consistent results between the 2015 and 2016 studies. The following list identifies the questions having highest frequency of Acceptable (A) responses in both Regions 2 and 3 (Exhibit 8).

BMP answered as Acceptable for greater than 75 percent of the sites (Exhibit 8, Tables 1 and 2)

- *Occurring in both 2015 and 2016* - Landings: Re-vegetated/stabilized/leveled as needed
- *Occurring in both 2015 and 2016* - Equipment Operation and Maintenance: Provided for adequate storage and disposal of fuel, debris, lubricants, fluids, and rinsate from equipment cleanup.
- *2016 Only* - Road Closure: Erodible soils stabilized by seeding, natural vegetation, or brush.
- *2016 Only* - Landing and/or Decking Areas: Drain surface water into buffer strip or vegetation and logging residue does not enter water bodies.

The 2016 study found several BMP applications to have Acceptable Variation (V) ratings. Only one question was identified where it was recorded on more than 10 percent of sites that required the BMP. Question 7d (RMZ minimum width ≥ 100 feet) was rated as Acceptable Variation (V) for 32 percent of the needed applications in Region 2 and 38 percent in Region 3. Region 1 had similar results with Acceptable Variation (V) making up 43 percent of the needed applications. This may continue to suggest that many RMZs that did not meet the minimum width may still provide adequate shade and sediment filtering for the nearby water body. Only 2 percent of the sites with RMZs found the width to be less than adequately sized to protect water quality in the 2016 study regions.

The 2015 and 2016 studies expanded upon question 7d (RMZ: Minimum width ≥ 100 ft) by taking three measurements within each RMZ to calculate the average width. The following table shows the results from Regions 2 and 3 (Table 10).

Table 10 – Regions 2 and 3: RMZ Width Results

Average RMZ Width		
	Region 2	Region 3
Percent of Sites With RMZs Averaging < 100 feet	33.3	46.7
Percent of Sites With RMZs Averaging ≥ 100 feet	66.7	53.3
Percent of Sites With Ruts in the RMZ	0.0	0.0

Each culvert occurrence required for the timber sale was recorded for each inspection. We found Regions 2 and 3 to have fewer culvert occurrences when compared to Region 1. Table 11 shows that over 30 percent of the culverts were not properly installed in Region 2. In comparison, Region 1 culvert data showed that 21 percent of culverts (cross drain and stream crossing) were not properly installed.

Table 11 – Culvert Inspection Results - Regions 2 and 3

Percent of Culverts Properly Installed		
	Region 2	Region 3
Percent Yes	66.7	100.0
Percent No	33.3	0.0

BMP applications that were not Applied Correctly (1) or Not Applied (2) when the BMP was needed was also assessed. The number of times a question was rated as "1" or "2" is outlined in the following table. The following tables summarize the top ten questions that most frequently received a negative rating (Tables 12 and 13).

Table 12 – Region 2: Negative Rating Questions

Questions Receiving Applied Incorrectly (1) or Not Applied (2)			
Questions Answered as Not Acceptable	Question ID	No. of Sites Coded 1	No. of Sites Coded 2
Skidding and Skid Trails: Excessive rutting avoided: 6 inches deep and 25 feet long in RMZ, 12 inches deep and 50 feet long in other areas.	5f	5	3
Skidding and Skid Trails: Rehabilitate skid trails as needed.	5h	0	4
Roads: Water diversion ditches installed properly.	2e	2	1
Roads: Crown road on sections crossing level ground or low areas.	2c	1	1
Roads: Cross drainage culverts properly sized (min. 12 inches) and installed.	2f	1	1
Road Closure: Water bars properly spaced and installed where slope of road requires and where temporary cross drainage culverts were removed.	3b	0	2
Road Closure: Erosion control features functional.	3c	1	1
RMZs: Buffer strip clearly established.	7c	0	2
Wetlands: Excessive rutting avoided; > 6 inches deep and 25 feet long.	8d	1	1
Other: Harvesting is timed for appropriate conditions and operations minimize rutting and compaction damage.	9d	1	1

Table 13 – Region 3: Negative Rating Questions

Questions Receiving Applied Incorrectly (1) or Not Applied (2)			
Questions Answered as Not Acceptable	Question ID	No. of Sites Coded 1	No. of Sites Coded 2
Roads: Broad base dips installed properly.	2d	2	6
Road Closure: Erosion control features functional.	3c	2	5
Road Closure: Erodible soils stabilized by seeding, natural vegetation, or brush.	3d	0	5
Skidding and Skid Trails: Rehabilitate skid trails as needed.	5h	0	5
Skidding and Skid Trails: Excessive rutting avoided: 6 inches deep and 25 feet long in RMZ, 12 inches deep and 50 feet long in other areas.	5f	1	3
Roads: Crown road on sections crossing level ground or low areas.	2c	2	1
Roads: Water diversion ditches installed properly.	2e	0	3
Road Closure: Water bars properly spaced and installed where slope of road requires and where temporary cross drainage culverts were removed.	3b	0	3
Skidding and Skid Trails: Water bars properly installed as needed.	5b	1	2
Skidding and Skid Trails: Gullies, seeps, and other permanently wet areas avoided where feasible.	5d	0	3

The most common categories where BMP applications were not applied correctly in the 2016 study were Skidding and Skid Trails, Roads, and Road Closures. This is fairly consistent with the findings in the 2015 study of Region 1, with Road and Skidding and Skid Trails being the most frequent categories with negative or insufficient ratings. In Region 1, negative ratings for the RMZ category were more frequent than found in

Regions 2 and 3. This could be partially explained by lesser RMZ-related BMP applications in Region 2 and 3, as noted earlier in the report (Tables 8 and 9). The question "Excessive rutting avoided: 6 inches deep and 25 feet long in RMZ, 12 inches deep and 50 feet long in other areas" was identified as most frequently rated either Applied Incorrectly (1) or Not Applied (2) in Regions 2 and Region 1. Region 3 found "Broad base dips installed properly" to be rated as not acceptable most frequently. Since roads and skid trails occur on almost all sales, and at a higher frequency than other BMP characteristics, it is understandable that they were identified during the studies to be more commonly rated as unacceptable applications (Table 13).

Further evaluation of the questions rated as "not acceptable (ratings 1 and 2)", looking at the negatively rated questions as a proportion of the times the application was needed, identifies different BMP applications to evaluate. Most often, the questions with a high percentage of negative rates are questions that are only necessary on less than 10 percent of the sites per region. For example, water diversion-related BMP applications on roads were found to have a high percent of negative ratings in both regions in the 2016 study. It was more common that these water diversion BMPs were not applied, opposed to being applied incorrectly (Tables 12 and 13).

Another question that received a negative rating greater than 10 percent of the time is "Wetlands: Excessive rutting avoided: > 6 inches deep and 25 feet long" (this occurred in all three regions). This is most likely caused by the difficulty in minimizing soil disturbance when harvesting in wetland environments and by the limited sites with wetland harvesting. Region 3 had several questions pertaining to stream crossings, but all negative ratings came from one site with a poor crossing. Region 3 also had several negative ratings regarding the protection of threatened and endangered species and archeological sites. These rating were determined from discussion with a landowner who was present during the site visit and acknowledged that no check was made (Tables 14 and 15).

Table 14 – Region 2: BMP Questions

BMP Questions with Greater Than 10 Percent Applied Incorrectly (1) or Not Applied (2) When BMP was Needed				
Questions Answered as Not Acceptable for > 10 Percent of Responses That Required BMP Application	Question ID	Percent of Sites Code 1 or 2	No. of Sites Coded 1 or 2	No. of Sites Coded A or V
Equipment Operation and Maintenance: Spills are cleaned up. If DEQ reporting threshold is met, then spill was reported.	1c	50.0	1	1
Stream Crossings: Cross drainage culverts properly sized (min. 12 inches) and installed.	4n	50.0	1	1
Roads: Cross drainage culverts properly sized (min. 12 inches) and installed.	2f	28.6	2	5
Road Closure: Water bars properly spaced and installed where slope of road requires and where temporary cross drainage culverts were removed.	3b	22.2	2	7
Roads: Water diversion ditches installed properly.	2e	21.4	3	11
Wetlands: Excessive rutting avoided: > 6 inches deep and 25 feet long.	8d	18.2	2	9
Roads: Broad base dips installed properly.	2d	16.7	1	5
RMZs: Vernal ponds protected from rutting and buffered.	7o	12.5	1	7

Table 15 – Region 3: BMP Questions

BMP Questions with Greater Than 10 Percent Applied Incorrectly (1) or Not Applied (2) When BMP was Needed				
Questions Answered as Not Acceptable for > 10 Percent of Responses That Required BMP Application	Question ID	Percent of Sites Coded 1 or 2	No. of Sites Coded 1 or 2	No. of Sites Code A or V
Road Closure: Water bars properly spaced and installed where slope of road requires and where temporary cross drainage culverts were removed.	3b	60.0	3	2
Other: Rare, threatened, and endangered species are protected if present.	9b	50.0	2	2
Roads: Broad base dips installed properly.	2d	40.0	8	12
Other: Archeological sites are protected if known to be present.	9a	33.3	1	2
Wetlands: Wetland crossings include placement of culverts and other structures to ensure adequate water flow and drainage.	8e	28.6	2	5
Stream Crossings: Natural stream channel disturbance minimized.	4d	25.0	1	3
Stream Crossings: Crossings do not impede fish migration.	4f	25.0	1	3
Stream Crossings: Sediment not being discharged into stream.	4i	25.0	1	3
Wetlands: Excessive rutting avoided: > 6 inches deep and 25 feet long.	8d	18.2	2	9
Roads: Water diversion ditches installed properly.	2e	13.0	3	20
Skidding and Skid Trails: Water bars properly installed as needed.	5b	13.0	3	20

BMP applications that resulted in a high frequency of Insufficient Information “0” ratings are identified in the following table. Questions answered primarily with a “0” code included those that required the confirmation of a permit or additional documentation. This additional data and research is difficult to obtain, and would require adjustments to the projects data collection procedures and landowner “survey” documents. Questions relating to protecting archeological sites and threatened and endangered species were often recorded as insufficient information (0) unless the landowner was present for the inspection to provide further insight or a protected feature was noticed during the inspection, such as a buffer around a nest (Tables 16 and 17).

Table 16 – Region 2: Insufficient Information Ratings

BMPs with Insufficient Information (0) on More Than 10 Percent of Sites		
Questions Answered with 0 for >10 Percent of the Sites in 2015	Question ID	No. of Sites Coded 0
Equipment Operation and Maintenance: If DEQ reporting threshold is met, then spill was reported.	1d	100
Roads: Regular road inspections performed and documented during and after harvesting	2n	64
Other: Archeological sites are protected if known to be present.	9a	98
Other: Rare, threatened, and endangered species are protected if present.	9b	98

Table 17 – Region 3: Insufficient Information Ratings

BMPs with Insufficient Information (0) on More Than 10 Percent of Sites		
Questions Answered with 0 for >10 Percent of the Sites in 2015	Question ID	No. of Sites Coded 0
Equipment Operation and Maintenance: If DEQ reporting threshold is met, then spill was reported.	1d	100
Roads: Regular road inspections performed and documented during and after harvesting	2n	68
Other: Archeological sites are protected if known to be present.	9a	97
Other: Rare, threatened, and endangered species are protected if present.	9b	96

3.2.2 Supplemental Timber Sale Questions

Following each site visit, the monitoring teams were asked to answer eight supplemental questions about the overall implementation of BMPs on the timber sale. Table 18 displays the results from several of these questions. The complete list of supplemental questions is found in Exhibit 9. The results of these supplemental BMP questions reported a high confidence in BMP conformance. Our analysis found that no sales in Region 2 and only 3 percent of timber sales in Region 3 did not meet the monitoring teams' expectations in protecting water quality. This is similar to the 2015 study of Region 1 that found three percent of sites did not meet expectations in protecting water quality. Sites that did not meet expectations had unacceptable ratings that included erosion of roads, excessive rutting in wetlands, or improper stream crossings, for example. Even with a rating of "Does not meet expectations," most of these concerns were found in sites rated as having either a moderate or slight impact on water quality. Only one site was rated as having a severe impact on water quality (Table 18).

Table 18 – Regions 2 and 3: Timber Sale Supplemental Question Summary (2016)

Did they implement all appropriate BMPs to control erosion? (S1)		
	Region 2	Region 3
Percent Yes	96.0	90.0
Percent No	4.0	10.0
Did the system of BMPs control erosion and sedimentation? (S2)		
	Region 2	Region 3
Percent Yes	97.0	92.0
Percent No	3.0	8.0
Site's overall rating considering application of BMPs with impact to water quality (S7)		
	Region 2	Region 3
Percent Exceeds Expectations	1.0	8.0
Percent Meets Expectations	99.0	89.0
Percent Does Not Meet Expectations	0.0	3.0
Site's overall impact on water quality (S7A)		
	Region 2	Region 3
Percent No impact	43.0	45.0
Percent Negligible	54.0	41.0
Percent Slight	3.0	10.0
Percent Moderate	0.0	3.0
Percent Severe	0.0	1.0

3.3 Comparison of Ownership

Similar to the 2015 results, the 2016 monitoring efforts found little difference between the landowner classes. The highest percentage of non-acceptable BMP ratings occurred on State sites in Region 2 and on NIPF sites in Region 3. However, these results varied by about two percent between ownerships and are likely not statistically different.

The 2015 BMP study of Region 1 found that questions rated as “NA” occurred on 49.4 to 53.6 percent of the BMP applications for the different landowner classes. In 2016, “NA” responses made up 58.9 to 62.2 percent of the response in Region 2 and 62.1 to 79.1 percent in Region 3. This strongly suggests an overall lesser need for BMP applications in the Eastern Upper Peninsula (Region 2) and the Lower Peninsula of Michigan (Region 3), compared to the Western Upper Peninsula (Region 1). Tables 19 and 20 display the ratios of ratings for when BMPs were needed by ownership class.

Table 19 – Region 2: Results by Landowner Class

Results by Landowner Class				
	Federal	Large Private	State/ County	NIPF
No. of Audit Sites	4	20	37	39
Percent of Needed:				
Applied Correctly (A)	98.1	97.6	97.0	96.5
Acceptable Variation (V)	1.9	1.1	1.5	2.2
Applied incorrectly (1)	0.0	0.2	0.5	0.8
Not Applied (2)	0.0	1.1	1.0	0.5
Percent of Total Sum:				
Applied Correctly (A)	33.3	34.2	35.0	32.0
Acceptable Variation (V)	0.6	0.4	0.5	0.7
Applied incorrectly (1)	0.0	0.1	0.2	0.3
Not Applied (2)	0.0	0.4	0.4	0.2
Not Applicable (NA)	62.2	59.9	58.9	61.8
Insufficient Info (0)	3.9	5.0	5.0	5.0
Total	100.0	100.0	100.0	100.0

Table 20 – Region 3: Results by Landowner Class

Results by Landowner Class			
	Federal	State/ County	NIPF
No. of Audit Sites	5	30	65
Percent of Needed:			
Applied Correctly (A)	100.0	96.3	95.9
Acceptable Variation (V)	0.0	1.1	1.2
Applied incorrectly (1)	0.0	0.8	0.4
Not Applied (2)	0.0	1.8	2.5
Percent of Total Sum:			
Applied Correctly (A)	15.1	25.6	31.9
Acceptable Variation (V)	0.0	0.3	0.4
Applied incorrectly (1)	0.0	0.2	0.1
Not Applied (2)	0.0	0.5	0.8
Not Applicable (NA)	79.1	68.1	62.1
Insufficient Info (0)	5.8	5.3	4.7
Total	100.0	100.0	100.0

3.4 Comparison of All Regions

This section evaluates the results of all three regions, looking at combined results from both the 2015 and 2016 efforts. This analysis provides an assessment of BMP compliance for the entire state of Michigan. A total of

299 sites were monitored between the 2015 and 2016 efforts. Table 21 shows that statewide BMPs were applied correctly 96.1 percent of the time in which they were needed. It also reports that BMPs were not applied when needed or not applied correctly 2.2 percent of the time.

Table 21 – All Regions: Summary Results

Results Summary		
Rating	No. of Observations	Percent of BMPs Needed
BMP Applied Correctly (A)	8,400	96.1
BMP Acceptable Variation (V)	149	1.7
BMP Applied Incorrectly (1)	67	0.8
BMP Needed & Not Applied (2)	122	1.4
BMP Application Not Needed (NA)	13,630	-
Insufficient Information (0)	879	-
Total BMP Applications Needed	8,738	-
Total BMP Applications Assessed	23,247	-

The comparison of each BMP application category shows that wetlands and stream crossings had the lowest percentage of BMPs needed at a rate of 6.4 percent each. Landings/decking areas and skidding/skid trails had the highest percentage of BMPs needed at reported rates of 85.3 percent and 65.3 percent, respectively (Table 22).

Table 22 – All Regions: Needed and Total Possible Observations by Category

Observations by Category			
Category	No. of Times BMP Was Needed	Total Possible Ratings	Percent BMP Needed of Total
1. Equipment Operation and Maintenance	513	1,097	46.8
2. Roads	1,901	4,186	45.4
3. Road Closure and Retirement	803	1,794	44.8
4. Stream Crossing	304	4,784	6.4
5. Skidding and Skid Trails	1,562	2,391	65.3
6. Landing and/or Decking Areas	1,530	1,794	85.3
7. Riparian Management Zones	1,488	4,809	30.9
8. Wetlands	76	1,196	6.4
9. Other Considerations	561	1,196	46.9
Overall	8,738	23,247	37.6

A total of 45.2 percent of the RMZs were found to be less than the minimum recommendation of 100 feet; yet, only 4.1 percent of the RMZs measured during the study were rated as not adequately protecting water quality (specifically providing acceptable shading and filter capacity) (Table 23).

Table 23 – All Regions: RMZ Width Analysis

RMZ Width Analysis	
Percent of Sites With RMZs Averaging <100 feet	45.2
Percent of Sites With RMZs Averaging ≥100 feet	54.8
Percent of Sites With Ruts in the RMZ	0.0

The following table reports the results of the supplemental question ratings. The results are very similar to those reported for each individual region, and suggests that the monitoring teams had high confidence in BMP application (Table 24).

Table 24 – All Regions: Supplemental Questions Ratings

Supplemental Question Ratings	
Did they implement all appropriate BMPs to control erosion? (S1)	
Percent Yes	92.3
Percent No	7.7
Did the system of BMPs control erosion and sedimentation? (S2)	
Percent Yes	94.3
Percent No	5.7
Site's overall rating considering application of BMPs with impact to water quality. (S7)	
Percent Exceeds Expectations	8.0
Percent Meets Expectations	90.0
Percent Does Not Meet Expectations	2.0
Site's overall impact on water quality. (S7A)	
Percent No impact	53.5
Percent Negligible	39.8
Percent Slight	5.1
Percent Moderate	1.3
Percent Severe	0.3

When comparing the overall BMP monitoring results, there was little difference between the individual ownership groups. These results are very similar to what was found within each region. Each ownership class had BMPs being applied correctly roughly 95 percent of the time they were needed. The rate at which BMPs were applied incorrectly or not applied when needed ranged from 1.7 to 3.2 percent across the ownership classes (Table 25).

Table 25 – All Regions: Results by Landowner Class

Results by Ownership				
	Federal	Large Private	State/County	NIPF
No. of Audit Sites	17	59	86	137
Percent of Needed:				
Applied Correctly (A)	95.4	96.2	95.9	96.4
Acceptable Variation (V)	1.4	2.1	1.7	1.5
Applied incorrectly (1)	1.6	1.0	0.6	0.6
Not Applied (2)	1.6	0.7	1.8	1.5
Percent of Total Sum:				
Applied Correctly (A)	34.1	42.8	33.9	35.0
Acceptable Variation (V)	0.5	1.0	0.6	0.5
Applied incorrectly (1)	0.6	0.4	0.2	0.2
Not Applied (2)	0.6	0.3	0.6	0.5
Not Applicable (NA)	61.0	52.7	60.3	60.0
Insufficient Info (0)	3.2	2.8	4.4	3.8
Total	100.0	100.0	100.0	100.0

Exhibit 11 summarizes the acceptable and unacceptable BMP applications from the combined statewide dataset.

4. Summary and Conclusions

The 2016 BMP Monitoring Project effort concluded a statewide evaluation that utilized an improved sample design and statistically sound sample size. This effort included 99 sites in 2015 and 200 sites in 2016. In-field monitoring data was collected in custom designed software on a tablet platform, which improved data quality and response consistency.

The study results from Regions 2 and 3 (Eastern Upper Peninsula and Lower Michigan) reported the following BMP inferences.

- The 2016 monitoring effort found that when BMPs were needed, the guidelines were Applied Correctly (A) 97.0 percent of the time in Region 2 and 96.1 percent of the time in Region 3 (Table 5). This compares to 95.0 percent in Region 1 (2015 study).
- The BMP category of “Landings and/or Decking Areas” had the highest occurrence of Applied Correctly (A) ratings in Region 2 (100.0 percent), and the BMP category of “Equipment Operation and Maintenance” had the highest occurrence of applied correctly (A) ratings in Region 3 (100.0 percent) (Tables 6 and 7).
- The question “Skidding and Skid Trails: Excessive rutting avoided: 6 inches deep and 25 feet long in RMZ, 12 inches deep and 50 feet long in other areas” was most frequently rated as unacceptable (Applied Incorrectly (1) or Not Applied (2)) for Region 2 and occurred on eight timber sales (Table 12).
- The question “Roads: Broad base dips installed properly” was most frequently rated as unacceptable (Applied Incorrectly (1) or Not Applied (2)) for Region 3 and occurred on eight timber sales (Table 13).

Statewide findings of interest include:

- RMZ BMPs are needed nearly 50 percent of the time in Region 1, 30 percent in Region 2, and only 15 percent in Region 3. Both Regions 2 and 3 had lower percent of BMPs needed in almost every category when compared to Region 1 (Tables 8 and 9).
- A total of 45.2 percent of RMZs statewide were less than the minimum recommendation of 100 feet; yet, only 4.1 percent of the RMZs measured during the study do not adequately protect water quality (specifically providing recommended shading and filter runoff capacities, Table 23).
- The monitoring teams found that over 93 percent of the timber sale sites had a “negligible” to “no impact” assessment ratings on water quality (Table 24).
- Little variation in BMP compliance occurred across landowner classes. Total BMP applied correctly (A) ratings varied by less than two percent among the ownership types (Table 25).

Statewide observations report that the categories of “Landings and/or Decking Areas” and “Skidding and Skid Trails” had the highest frequencies of BMPs needed (occurrences where the BMP was applicable). Since skid trails and landing/decking areas occur on all sales, it is understandable that these BMP applications were commonly identified during the study. On the other hand, stream crossings and wetland BMPs were required the least (Table 22).

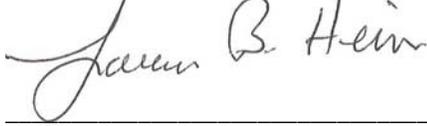
In 2015, BMP applications within the “Stream Crossings” category had four out of the top ten BMP questions with unacceptable ratings greater than ten percent of the time they occurred. This was the case even though the stream crossings category had a low frequency of BMPs being needed. In Region 3, the negative ratings for the stream crossing category all came from one site (Table 15). Additionally, the questions regarding “Roads and Road Closures” appeared more often in the top ten questions that had unacceptable ratings. One question in particular showed up in both Regions 2 and 3 with high percentages of Applied Incorrectly (1) or Not Applied (2); “Roads: Broad Based Dips Installed properly” had results of 16.7 percent and 40.0 percent respectively (Tables 14 and 15).

“RMZ Width \geq 100 feet,” was identified as the BMP application most commonly receiving a rating of Acceptable Variation (V) in all regions. The results found acceptable variation ratings for this question 40 percent of the time for RMZ widths in Region 1, 32 percent of the time in Region 2, and 38 percent of the time in Region 3. As identified in 2015, this BMP application should continue to be evaluated over time, so that standards can be updated and utilized in future BMP manual updates and forest harvesting operations.

In summary, the results of the statewide BMP monitoring effort found a high level of conformance with the current guidelines. Compliance through ratings of Applied Correctly (A) and Acceptable Variation (V) exceed 97 percent for all three regions (Table 21). The 2016 efforts found the highest levels of compliance, with Region 2 having positive ratings 98.7 percent of the time (Table 5). Statewide monitoring teams found only two percent of the sites did not meet overall water quality expectations, as defined by the site-level supplemental questionnaire (Table 24).

Submitted by:

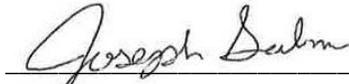
STEIGERWALDT LAND SERVICES, INC.



Laura B. Heier
Private Forest Management Operations Director



Forrest M. Gibeault
Analysis and Investment Operations Director



Joseph P. Salm
Forest Analyst Assistant



Robert J. Anderson
Forest Analyst Assistant

5. Certification

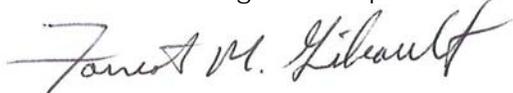
I certify that, to the best of my knowledge and belief:

- a. The statements of fact contained in this report are true and correct.
- b. The reported analyses and conclusions are based on the monitoring cooperators' personal, impartial, and unbiased professional analyses, opinions, and conclusions.
- c. All monitored timber sales were applied unique IDs and aggregated to allow for confidentiality, and the dataset provided for the study only allowed for inference at the ownership levels reported.
- d. I have no present or prospective interest in the subject of this report and no personal interest with respect to the parties involved.
- e. I have no bias with respect to the subject of this report or to the parties involved with this assignment.
- f. My engagement in this assignment was not contingent upon developing or reporting predetermined results.
- g. My compensation for completing this assignment is not contingent upon the development or reporting of predetermined results or directions that favor the cause of the client, the attainment of a stipulated result, or the occurrence of a subsequent event directly related to the intended use of this report.

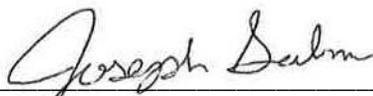
STEIGERWALDT LAND SERVICES, INC.



Laura B. Heier
Private Forest Management Operations Director



Forrest M. Gibeault
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Joseph P. Salm
Forest Analyst Assistant



Robert J. Anderson
Forest Analyst Assistant

Exhibit 1

Oversight Committee Members and Observations



February, 2017 Oversight Committee Observations on the 2015 & 2016 BMP Monitoring Project

Oversight Committee Members: Steve Shine, Robert O'Meara (2015), Ben Schram, Larry Pedersen, Charlie Becker, Scott Robbins

The Oversight Committee is very pleased with the performance of Steigerwaldt in carrying out the 2015 & 2016 BMP Monitoring Project and the submitted reports on the Project. The following are additional observations by the Committee.

Contracted Audit vs. Volunteer Audit Comparison

Prior volunteer BMP Monitoring Projects fostered cross-ownership and cross-discipline communication on BMPs which, overall, was given very high marks. The monitoring often served as an opportunity to enhance understanding of others' concerns and direct exposure to field conditions (which generally were quite good) and impacts (which generally were quite minimal). However, the volunteer participation did require substantial intensive participation over several months and was perceived to be a burden on agencies and firms engaged in the efforts. The time requirements inhibited the number of sites which could be visited by volunteer teams, thereby constraining the statistical legitimacy of extrapolating the results to all timber harvesting practices in the State of Michigan. There is also potential variability between different volunteer audit teams versus consistent audits carried out by experienced contractors. The 2015 and 2016 audits visited almost ten times the number of sites than the two previous audits. Also, a large percentage of the 2015 and 2016 monitoring teams did have significant participation by project cooperators, although there was less participation by state and federal representatives.

Having an adequate, representative sample of logging sites is a primary objective of the BMP Monitoring Project; it provides the basis to be able to say with some certainty that logging practices generally have minimum impacts on soil and water quality. It also enables more certainty as to what items and issues need to be emphasized in future BMP educational efforts and discussions. An overwhelming priority for the 2015 and 2016 audits was to conduct audits on a large pool of sites to derive statistically sound conclusions about the application of BMPs in Michigan. To a degree, there is a tradeoff between efficiently and effectively auditing a large sample of sites and having extensive audit participation both by landowners and collaborating partners. To the extent that participation is lost due to tight timetables for completing a large number of audits, some support by partners and interested parties may be risked. However, the fact is that less participation enables quicker audits and more audits to be conducted - leading to more confidence in statistically extrapolating the results to all logging operations. The issue of audit participation versus visiting a larger number of sites will always be a consideration for BMP audits.

Comments on the Process and Lessons Learned

The contractor demonstrated the ability to carry out a large number of audits in a very short time period. For the first time, sites from the southern lower peninsula were included with those from the rest of the State. There was good use of past forms, tables, and reporting format which enables comparison of results over time. For example, the 2015 and 2016 audits showed once again how there is evidence of a need to apply more BMPs in the western UP.

An initial complication was getting the participation and pool of sites set up. Maintaining involvement and the interest of a variety of landowners is a struggle. In addition, due to the budgetary approval process, the 2015 western UP regional audit was compacted into too short of a timeframe to enable:

- Assembling a larger pool of potential audit sites to draw from (both corporate, but particularly NIPF)
- Better BMP Monitoring Project participation by landowners in the sample and better State participation on the monitoring teams.

A large, representative NIPF sample is necessary to achieve an unbiased, random sample of logging sites. NIPF participation has been an ongoing struggle in past audits; the 2015 audit made much progress on incorporating a large pool of NIPF sites into the BMP Monitoring Project. NIPF participation is of particular importance in Michigan's lower peninsula which was covered by the 2016 audit. More time to prepare and carry out 2016 audits led to continued improvement on NIPF inclusion in the 2016 audits. An intensive effort went into identifying potential NIPF participants in the 2016 audits through written and verbal contacts with Conservation District Foresters, loggers, Tree Farm participants, forest product mills, consulting foresters, and State CFA, CFR, and QF programs. *(Some of this correspondence is captured as Exhibits 4 and 5.)*

FIA data showed that the number of monitoring sites selected by landowner class was closely reflective of the proportion of timber harvests by landowner class, thereby providing a statistically sound sample of BMP practices. It also closely corresponded overall to past ownership shares of monitoring sites, although past monitoring had many fewer sites.

Additional Items

- The audits did not achieve past levels of participation by the National Forests and the State Department of Environmental Quality and DNR Fisheries and Forestry staff. Future audit participation by the State is important for firsthand monitoring of BMP performance across ownerships, audit grant performance, understanding complications with BMP compliance and logging industry operations, and possible future revisions to the BMP manual.
- The stream crossing permit documentation issue needs to be addressed by having the landowner or the landowner's representative on site or to have time to contact them to verify when questions arise.
- The 2015 and 2016 results provide a sound basis for collaborative updating of BMP educational materials and efforts, along with the BMP manual itself.

Exhibit 2

BMP Introduction from Fall 2014 Report
Prepared by Dr. Larry Pederson



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.

Exhibit 3

Monitoring Team Cooperators



2016 Monitoring Team Cooperators

Steigerwaldt Land Services, Inc.

Laura Heier
Private Forest Management Operations Director

Lauren Rusin
Staff Forester/Michigan Representative

Brock Tetzlaff
Assistant Project Forester

Kyle Dunlap
Project Forester

Derek Schummer
Assistant Project Forester

Green Timber Consulting Foresters

Brian Nordstrom
Forester

Rexx Janowiak
Senior Forester

Michael Schreiber
Management Planning Director

Martell Forestry, Inc.

Kaytlyn Brinkman
Forester

Project Cooperators (agency representatives)

Anne Collins
Tuscola/Bay/Huron/Sanilac Conservation District
Forester

Brittany VanderWall
Presque Isle/Cheboygan Conservation District
Forester

Brook Alloway
Alpena/Montmorency Conservation District
Forester

Bryan Shideler
Claire/Gladwin Conservation District Forester

Eric Brandon
Alcona/Iosco Conservation District Forester

Matt Watkeys
Alger/Marquette County Conservation District
Forester

Travis Kangas
Chippewa/Luce/Mackinac Conservation
District Forester

Michael Pauling
Oceana/Newaygo Conservation District
Forester

Ben Schram
Michigan Department of Agriculture and Rural
Development

Roxanne Merrick
Michigan Department of Natural Resources

2015 Monitoring Team Cooperators

Steigerwaldt Land Services, Inc.

Laura Heier
Private Forest Management Operations Director

Forrest Gibeault
Analysis and Investment Operations Director

Lauren Rusin
Staff Forester/Michigan Representative

Ben Williams
Project Forester

Sarah Fisher
Project Forester

Kyle Dunlap
Staff Forester

Joseph Salm
Staff Forester/Assistant Analyst

Green Timber Consulting Foresters

Justin Miller
President

Michael Schreiber
Forester

Justin Kirby
Forester

Project Cooperators (agency representatives)

Cory Howes
Gogebic County Conservation District Forester

A.J. Campbell
Dickinson County Conservation District Forester

Roger Jaworski
Iron County Conservation District Forester

Matt Watkeys
Marquette County Conservation District Forester

Greg Ryskey
Gogebic County Forest Director

Exhibit 4

Land Managers Data Request Letter





856 North 4th Street
Tomahawk, WI 54487

tel: 715-453-3274

11242N Gorski Road
Hayward, WI 54843

tel: 715-699-1401

213B North Front Street
Marquette, MI 49855

tel: 906-273-0661

84 East 2nd Street
Chillicothe, OH 45601

tel: 740-702-8000

www.steigerwaldt.com

FORESTLAND MGMT

INVESTMENT & ANALYSIS

APPRAISAL

RIGHT-OF-WAY

ENVIRONMENTAL

June 1, 2016

Re: Michigan Forest Products Council BMP Monitoring Program

Dear Land Manager:

The purpose of this letter is to request your cooperation in providing data for recently completed timber sales on properties located in the Lower Peninsula and eastern region of the Upper Peninsula of Michigan. This is the second phase of the Michigan Best Management Practices (BMP) monitoring effort. The 2015 monitoring project took place in the western Upper Peninsula, and land manager cooperation was key to the success of this effort. We are once again partnering with Green Timber Forestry (Pelkie, Michigan) to assist with the assessment of BMP implementation in the state. This project is being directed by the Michigan Forest Products Council Foundation.

The goal of this effort is to determine if BMPs, specifically relating to forestry operations, are meeting soil and water protection goals and how the use of BMPs is affecting water quality and forest ecosystems. This effort is **NOT** intended to be regulatory, and landowner participation is completely voluntary.

If you choose to participate in this project, we ask that you provide data for all timber sales greater than five acres, and active within the last two years (**May 1, 2014 through April 30, 2016**) that are now closed.

Timber sale inspections will occur in July through September. The timber sale selection process will be occurring over the next few weeks. We appreciate your ability to quickly respond to this request.

For this initial request we would appreciate a listing of all timber sales meeting the date requirements outlined above that are located within the following counties:

- **Eastern Upper Peninsula: Alger, Delta, Menominee, Schoolcraft, Luce, Mackinac, and Chippewa County**
- **Lower Peninsula: All counties.**

The attached spreadsheet includes the data we need to make a random selection of timber sales within each ownership group. We also ask that GIS shapefiles of the sale area be provided, if available.

Following preliminary selection we will be asking for any additional available information on a subset of these sales.

To meet our goal of beginning field work by mid-July, we ask that you forward the timber sale data to us by **June 20th, 2016**. Following the random selection process, we will contact all owners of selected sales for additional information.

Thank you for your time and cooperation. Please contact Forrest Gibeault with any questions regarding this letter.

Sincerely,

STEIGERWALDT LAND SERVICES, INC.

Forrest M. Gibeault
Analysis and Investment Operations Director
forrest.gibeault@steigerwaldt.com

FMG/jlt
Enc.: As stated

Exhibit 5

Non-Industrial Private Forestland Owners Data Request Letter





July 18, 2016

Dear Forest Landowner:

In 2015, we began a three-year state funded program to monitor the effectiveness of forestry operations at protecting water quality and soil integrity.

Your forestland has been identified as having a recent timber harvest, so we are asking permission to enter your land to evaluate the effectiveness of Michigan's forestry Best Management Practices (BMPs) during this harvest operation.

Your property's data will be kept confidential at all times, and in no way will your property's specific information be made known. This project is to gather information only. Regardless of our findings on your property, no penalties will be given to you or any party involved in managing your property.

Knowing how our voluntary statewide system is being implemented during forest operations is extremely important. It will give us the data we need to reassure the public that logging operations are extremely beneficial and that mandates and laws are not needed to protect these forested environmental assets.

Please read the accompanying information for more detail. If you agree to participate, we thank you in advance for allowing us to access your timber harvest and monitor how soil and water were protected. Feel free to contact me with any comments or questions.

Sincerely,

Scott Robbins
Director of SFI & Public Affairs
Michigan Forest Products Council
srobbins@michiganforest.com
[517.853.8880](tel:517.853.8880) office
[906.250.5027](tel:906.250.5027) cell
<http://www.sfimi.org/>
www.michiganforest.com



856 North 4th Street
Tomahawk, WI 54487
tel: 715-453-3274

11242N Gorski Road
Hayward, WI 54843
tel: 715-699-1401

213B North Front Street
Marquette, MI 49855
tel: 906-273-0661

84 East 2nd Street
Chillicothe, OH 45601
tel: 740-702-8000

www.steigerwaldt.com

FORESTLAND MGMT

INVESTMENT & ANALYSIS

APPRAISAL

RIGHT-OF-WAY

ENVIRONMENTAL

July 18, 2016

Re: Michigan Forest Products Council BMP Monitoring Program

Dear Landowner:

The purpose of this letter is to request your cooperation in providing data for recently completed timber sales on your property located in the Lower Peninsula and eastern region of the Upper Peninsula of Michigan. This is the second phase of the Michigan Best Management Practices (BMP) monitoring effort. The 2015 monitoring project took place in the western Upper Peninsula, and landowner cooperation was key to the success of this effort. We are once again partnering with Green Timber Forestry (Pelkie, Michigan) to assist with the assessment of BMP implementation in the state. This project is being directed by the Michigan Forest Products Council Foundation.

The goal of this effort is to determine if BMPs, specifically relating to forestry operations, are meeting soil and water protection goals. This effort is **NOT** regulatory, and landowner participation is completely voluntary. All information collected will be kept confidential, and project findings will be in no way tied to your property.

If you choose to participate in this project, we ask that you provide data for all timber sales greater than five acres and active within the last two years (**May 1, 2014, through April 30, 2016**) that are now closed.

Timber sale inspections will occur in August and September. The timber sale selection process will be occurring over the next few weeks. We appreciate your ability to quickly respond to this request.

For this round, we would appreciate information on all timber sales meeting the date requirements outlined above that are located within the following counties:

- **Eastern Upper Peninsula: Alger, Delta, Menominee, Schoolcraft, Luce, Mackinac, and Chippewa Counties**
- **Lower Peninsula: All counties**

The attached form includes the data we need to make a random selection of timber sales. We ask that timber sale maps or GIS shapefiles of the sale area be provided, if available.

To meet our goal of beginning field work by August, we ask that you forward the timber sale data to us by **August 5th, 2016**. Following the random selection process, we will contact all owners of selected sales.

Thank you for your time and cooperation. Please contact Forrest Gibeault with any questions regarding this letter.

Sincerely,

STEIGERWALDT LAND SERVICES, INC.

Laura B. Heier
Private Forest Management Operations Director
laura.heier@steigerwaldt.com

LBH/jlt

Enc.: As stated

Property Inspection Authorization Form

Landowner Name _____

_____ I agree to grant permission for the guideline monitoring team to enter my property to complete an on-site evaluation as part of the Michigan Forest Products Foundation efforts to monitor Best Management Practice (BMP) implementation on forestlands. A member of the monitoring team will notify me five days in advance of the inspection date (***Please complete part two if you agree to participate.***)

_____ I would like to be present during the on-site inspection on my property.

_____ I decline participation in the program. Reason (optional)

Signature _____

Date _____

Please select your preferred contact method.

- Phone _____
- Email _____
- Mail/address _____

Contact Person _____
(if other than above)

Phone _____

Site Information Questionnaire

- 1) Has the timber harvest been completed in its entirety? Y N

- 2) Did you work with a forestry consultant? Y N
 - a. If yes, do you give us permission to contact them to request and/or discuss the timber harvest that occurred on your property? Y N

Consultant/Company Name _____

Phone Number _____ Email Address _____

- 3) Are you willing to supply the timber sale map(s) or other associated documents pertaining to the timber harvest on your property? Y N
 - a. If yes, please return documents with this packet.

- 4) Other notes or information you would like to share about the property or access.

**Thank you for taking the time to complete this questionnaire.
We will contact you if your site has been selected for on-site monitoring.**

Exhibit 6

BMP Field Monitoring Manual





STATE OF MICHIGAN

BMP MONITORING PROJECT

PROCEDURES MANUAL

2016



Background

Project Objective

The goal of this project is to determine if BMPs specifically relating to forestry operations are meeting soil and water protection goals, and how the use of BMPs is affecting water quality and forest ecosystems. This is determined by assessing compliance and results for voluntary BMP regulations across all major landowner groups (Federal, State, Large Private, and Small Non-Industrial Private). This project is being directed by the Michigan Forest Products Council Foundation (MFPC) and carried out primarily by Steigerwaldt Land Service, with assistance from Green Timber Consulting Foresters (GTCF).

Project Location

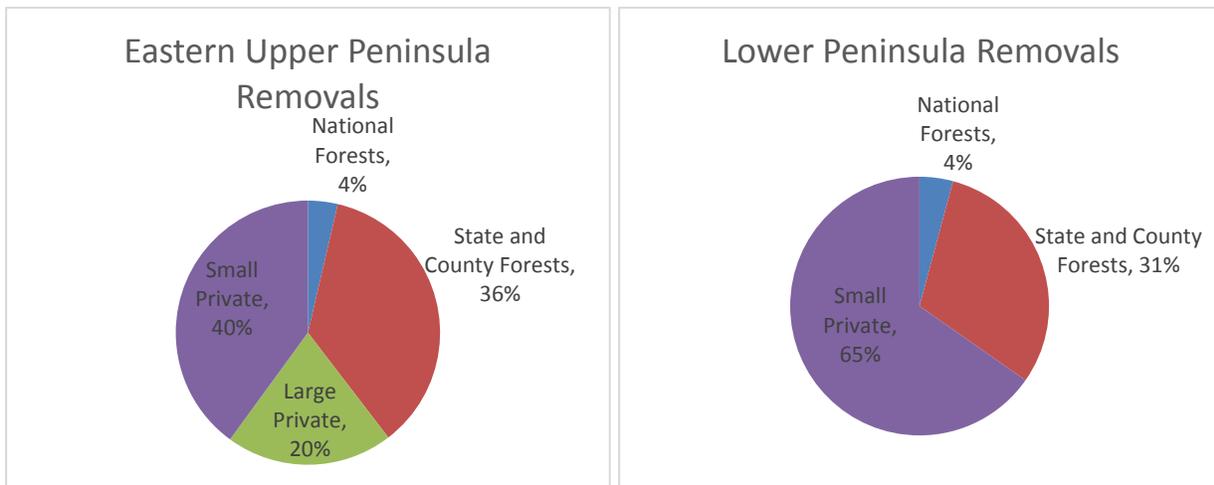
For this project, Michigan has been broken into three major regions (Western Upper Peninsula, Eastern Upper Peninsula, and Lower Michigan). The Western UP was monitored in 2015. The focus of 2016 will include the Eastern Upper Peninsula and the entire Lower Peninsula.

Teams

Teams will consist of one Steigerwaldt or GTCF project forester, one Steigerwaldt or GTCF staff forester, and one MI DNR or conservation district agency representative. Additional forestry sub-contractors may be secured for monitoring assistance in Lower Michigan.

Sites

This project will inspect 100 sites in each region for a total of 200 sites. These sites have been allocated to different ownership classes based on their proportion of removals recorded by the USDA's Forest Inventory and Analysis program. Sites selected for this project are timber sales that were active sometime between May 1, 2014, and April 30, 2016, that are now completed. Each site selected shall be assigned a reference number to ensure privacy for forest landowner participants. The following pie chart displays what percentage each ownership class contributes to the total harvest removals.



Project Procedures

Equipment List:

- iPad
- Field Worksheet
- 10 BAF Prism
- Clinometer
- Tatum
- Cruise Manual
- Logger Tape
- Property and Cruise Maps
- Laser Range Finder
- Manual

General Procedures

To monitor the site, travel the majority of the sale area, making sure to visit any areas in proximity to water features, such as streams, rivers, lakes, or wetlands. Apply a rating to each question outlined in the Field Worksheet or Forest Metrix Database on the iPads. The questions in the field worksheet are identical to the questions in the database. While walking the site, the team leader will use the iPad to record site findings. Other team members can use paper copies to take notes. After all members have walked the site, the group will compare their findings and agree to a final consensus that will be recorded in the database.

Alternative Sites

If you are unable to access a sale, or you arrive at a sale that is active, you can replace that sale with an alternative sale of the same landowner class. If a large sale has multiple units in different levels of completion, monitor all completed sale units instead of using an alternative sale. Alternative sites are numbered between 101 to 200. Refer to the sale selection table for details.

Rating Guide

Each monitoring team member should apply one of the ratings listed below to each question. Some questions do not need a rating since other information is asked, e.g., yes/no, a box to be checked, or a measurement. Once you have given each question a rating, answer the supplemental questions listed at the end.

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)

Example

Question 4c (Cross stream at right angles) Record the following if:

- A - While monitoring the site, you observe that streams were crossed at a 90-degree angle and the crossings had minimal impact on water quality.
- V - You notice that several crossings are not at a 90-degree angle, but do not appear to be eroding or having a negative impact on water quality.
- 1 - Crossing is at a 60-degree angle and is having a negative impact on water quality.

- 2 - Stream is crossed without a water crossing structure in place. Water quality has been impaired.
- 0 - For some reason you are unable to tell if crossing(s) were used in accordance with guidelines or if a negative effect on water quality.

Comments/Pictures

Record comments for any questions where additional information would help to assess the site's soil and water quality, especially sites where a negative rating is applied. If you are recording information on the iPad, we encourage you to take pictures of the site relating to the various questions.

Detailed Question Information

Culverts (Question 4g): While walking the sale, record all the parts of question 4g for each culvert you find that was installed for the purpose of completing the timber sale being monitored. If an existing culvert is in place for regular access, it does not need to be evaluated. Ocular measurements of culvert diameter should be recorded.

Questions Pertaining to Permits, Inspections, and Reporting (1d, 2m, 2n, 4b, 5g, 7b, and 8b): Many of these permits, such as water crossings, should be stapled to a nearby tree. If you find that a permit, inspection, or report described in a particular question was needed, but you cannot find it, record 0 (Insufficient Information to Rate). After field monitoring is complete, we may follow up with landowners to ask if appropriate permits were acquired. If you do not find a reason for a permit, inspection, or reporting described in a particular question, then record NA (BMP Not Applicable).

Trout Streams (Question 7d) **and State Natural River and Wild and Scenic Rivers** (Question 7a and 7b): To identify trout streams and wild and scenic rivers, you can either look at the hard copy maps or the trout stream layer on the handheld units.

RMZ Width (Question 7d): For this question, take three measurements evenly spaced across the RMZ of its width in feet. This question does not require a rating. The number entered into the iPad should be the average of the three measurements. Notes including the three measurements should be kept for future reference.

Native Seeding (Question 3e): Reference Appendix E in "Sustainable Soil and Water Quality Practices on Forest Land" for information regarding native seeding.

Shade Tolerant/Intolerant Management (Question 7e): Landowners can choose to manage their RMZ for either shade tolerant or shade intolerant species. Rate one of the questions listed for 7e (E or EE) and record NA for the other if only one management type is present. For designated trout streams, managing for shade tolerant species is required.

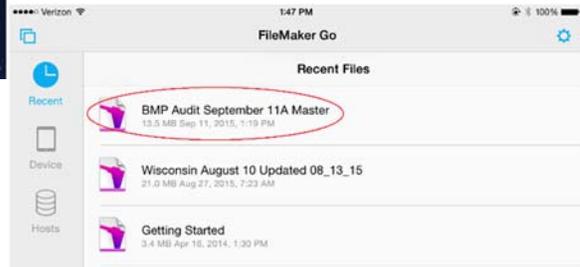
RMZ Questions: If questions pertain to an RMZ, but no RMZ exists, record N/A for all rating questions and leave Y/N and percent questions blank.

Be sure to answer all questions based on the tab they are in. For example, 2FF % Culverts properly size: because this question appears in the roads tab, you should only answer based on culverts used on the road, not culverts used for skid trails.

MI BMP Monitoring iPad Procedures

Getting Started

Launch the app by selecting FileMaker Go



Select "2016 07 13 BMP Audit" (or the most current template).

To start off, enter the initials of the people on your team that day, the date, and the 1-3 digit sale code number found on the timber sale maps. Then press "START NEW FILE."

***It is important you do this right away to prevent making changes to the template.**

*The file will then be named "MI-Site Code-Initials-Date"

Example: MI-3-jps-9-11-15

Enter audit team names, month, day, and year.

START NEW FILE

AUDIT TEAM

M D Y

SALE CODE



Once you have started a new file, press the "SITE" button at the top of the screen to start recording data.

Site Information

Start data collection by entering all the information on the "SITE" tab.



Press the "SET SITE LOCATION" button to record your current position. This can be taken anywhere on site.

*For "AUDIT REGION," select either the Eastern Upper Peninsula or Lower Peninsula.

*If you do not know whether the landowner is certified, select "NA."

Forest METRIX

MichiganBMP2015-jpsrja-9-11-15

SITE 1 2 3 4 5 6 7 8 9 SUPP

SET SITE LOCATION LAT
LONG

DATE REVIEWED

AUDIT TEAM

CODE NUMBER

SALE NAME

AUDIT REGION

OWNERSHIP CLASS FED STATE CORP NIPP

Question Tabs

After you have entered all site information, review each numbered tab and fill out the appropriate information. Comments (COMM) and pictures (PIC) should be added if needed.

For tabs that don't apply to your specific sale, press the orange "FILL NA" button to populate all the fields in that tab with NA.

Culverts

If the timber sale has any culverts, press the "ADD CULVERT" button and record the information for the culvert. Record information for each culvert as directed on page 4.

*Press the "SET" button to assign GPS coordinates to the culvert.

*If your stream width cannot be found in the options listed, use the "STREAM WIDTH" dropdown menu, scroll to the bottom and press "Edit Values..." this will allow you to add stream widths to the dropdown list. Stream widths are important to collect in the field as the *Hasty Method* for determining proper culvert size will be used. A chart of the Hasty Method will be provided.

Supplemental Questions

After you complete all the information on the numbered tabs, select the SUPP tab to answer the supplemental questions for the site. Record NA in any questions that do not apply.



Saving and Closing / Starting a New Timber Sale

Once you have completed the site, press the "SAVE & CLOSE FILE" button to return to the FileMaker homepage. When you want to start recording information for the next sale, select "2016 07 13 BMP Audit" (or the most current template) to start a new file.



Uploading Data to Dropbox

On the FILE page, steps are listed on how to upload your file to Dropbox, but once you hit "SAVE AND CLOSE," you are no longer able to read these instructions.

After you close out of the Forest Metrix database, you will be returned to the FileMaker Go homepage. Select "Device" on the left hand side of the screen to view all databases stored on the device. Then press the checkbox icon in the right-hand corner to make the databases selectable.

INSTRUCTIONS FOR DROPBOX UPLOAD

- 1) SAVE & CLOSE FILE
- 2) Touch "DEVICE" in left hand column of FileMaker
- 3) Touch checkbox icon in upper right
- 4) Select file to upload
- 5) Touch upward arrow icon in upper left
- 6) Touch "Open in DropBox" (you must have the DropBox app installed and logged in on the iPad)
- 7) Choose the appropriate DropBox folder
- 8) Touch "Choose" at the bottom of the screen
- 9) Touch "Save" at the top of the screen



Then select the database you want to upload to Dropbox, and press the upward arrow icon in the upper left.



Once in Dropbox, press "Save" to upload your file.

***Be sure to do this when you have Wi-Fi or very good cell coverage!**

After the upload is complete, press the circle button at the bottom of the iPad to return to the home page, then go back into FileMaker. Once in FileMaker, press "Done" to return to select files.



Other Notes

Report Page:

To exit out of the report page, press the Steigerwaldt logo.



Returning to File Maker Home:



To return to the FileMaker home page, press the square icon in the left hand corner and press "Home."



Exhibit 7

Field Monitoring Worksheet



**STATE OF MICHIGAN
2016 FOREST SOIL AND WATER QUALITY REVIEW
FIELD WORKSHEET**

DATE SITE REVIEWED: _____

OWNERSHIP CLASS:

CODE NUMBER: _____

FEDERAL

SALE NAME: _____

STATE

AUDIT REGION: _____

CORPORATE

AUDIT TEAM: _____

NIPF

CERTIFIED LANDOWNER:

YES NO

If yes, what certification system: SFI/FSC

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	APPLICATION 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.		
1c	Spills are cleaned up.		
1c	If DEQ reporting threshold is met, then spill was reported.		
2 Roads			
2a	Avoided placing roads in RMZ or were placed at a minimum distance of 100' from the stream.		
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.		
2b	Is rut in RMZ - yes or no dropdown		
2b	% of Rutting in Rmz- check one box		<input type="checkbox"/> <25% <input type="checkbox"/> 26-50% <input type="checkbox"/> 51-75% <input type="checkbox"/> >75%
2c	Crown road on sections crossing level ground or low areas.		
2d	Broad base dips installed properly.		
2e	Water diversion ditches installed properly.		
2f	Cross drainage culverts properly sized (min 12") and installed.		
2f	% of Culverts Properly Sized- check one box		<input type="checkbox"/> <25% <input type="checkbox"/> 26-50% <input type="checkbox"/> 51-75% <input type="checkbox"/> >75%
2g	Drain surface water into filter strip or vegetative draw.		
2h	Energy dissipaters at cross drainage and/or stream culvert outlets where necessary.		
2i	Obstacles: avoid gullies, seeps, springs, wetlands, and poor drainage areas where possible.		
2j	Roads out sloped where gradient permits. Where in-sloped (gradients 15%), adequate cross drainage is provided to protect water quality.		
2k	Road cuts sloped and stabilized to minimize water quality impacts.		
2l	Roads follow contour with grades between 2% and 10%. Grades exceeding 10% do not exceed 300' in distance.		
2m	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.		

3 Road Closure and Retirement:			
3a	Temporary cross drainage culverts and stream crossings removed.		
3b	Water bars properly spaced and installed where slope of road requires and where temporary cross drainage culverts were removed.		
3c	Erosion control features functional.		
3d	Erodible soils stabilized by seeding, natural vegetation or brush.		
3e	Plantings utilize native seed species where possible, see Appendix E.		
3f	Properly close and/or sign abandoned or infrequently used roads.		
4 Stream Crossings (permanent & temporary)			
4a	If NO stream crossings, skip to #5		<i>If skipping to #5, please comment with NA for each</i>
4b	Stream crossing permit obtained and followed.		
4c	Cross streams at right angles.		
4d	Natural stream channel disturbance minimized.		
4e	Stream bank approaches properly designed.		
4f	Crossings do not impede fish migration.		
4g	Culvert properly sized and installed. [Multiple Entry Option, fill out for each culvert on the property.]		
4g	Stream width _____ feet (numeric entry) [Multiple Entry Option]		
4g	Culvert size _____ inches (numeric entry) [Multiple Entry Option]		
4h	Culverts properly armored if needed.		
4i	Sediment not being discharged into stream.		
4j	Stream crossings follow contour with grades between 2% and 10%. Grades exceeding 10% do not exceed 300' in distance.		
4k	Crown road on sections crossing level ground or low areas.		
4l	Broad base dips installed properly.		
4m	Water diversion ditches installed properly.		
4n	Cross drainage culverts properly sized (min 12") and installed.		
4o	Drain surface water into filter strip or vegetative draw.		
4p	Energy dissipaters at cross drainage and/or stream		

	culvert outlets where necessary.		
4q	Obstacles: avoid gullies, seeps, springs, wetlands, and poor drainage areas where possible.		
4r	Temporary water crossings satisfactorily removed at termination of harvest activity.		
5 Skidding & Skid Trails			
5a	Gradients no steeper than 40%, average slopes no more than 15%.		
5b	Water bars properly installed as needed.		
5c	Drain surface water into buffer strip or vegetative draw with energy dissipaters as needed.		
5d	Gullies, seeps and other permanently wet areas avoided where feasible.		
5e	Zigzag pattern – break grade to avoid long slopes.		
5f	Excessive rutting avoided: 6 inches deep and 25 foot long in RMZ, 12 inches deep and 50 feet long in other areas.		
5f	Is rut in RMZ - yes or no dropdown		
5f	% of Rutting in RMZ- check one box		<input type="checkbox"/> <25% <input type="checkbox"/> 26-50% <input type="checkbox"/> 51-75% <input type="checkbox"/> >75%
5g	Stream crossing permit obtained if skidding across stream.		
5h	Rehabilitate skid trails as needed.		
6 Landings and/or Decking Areas			
6a	Located outside RMZ		
6b	Provide for adequate drainage.		
6c	Proper water diversion devices in working order.		
6d	Drain surface water into buffer strip or vegetation and logging residue does not enter water bodies.		
6e	Erosion control features functional, no movement of soil from the landing area.		
6f	Re-vegetated/stabilized/leveled as needed		

7 Riparian Management Zones			
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.		
7c	Buffer strip clearly established.		
7d	Minimum width ≥ 100 ft.		
7d	If there is a designated trout stream less than 50' in width, is the RMZ width increased appropriately		
7d	RMZ width _____ feet (numeric entry) [Three width measurements per RMZ]		_____ 1 _____ 2 _____ 3
7e	Left 60-80 BA within the RMZ when managing for shade tolerant spp.		
7e	Left 20-25 BA or ¼ to ½ acre clearcut patches within the RMZ when managing for shade intolerant spp.		
7f	Less than 10% of soil exposed within the strip.		
7g	Left late successional trees in RMZ.		
7h	Retained sufficient cover to maintain shading of the stream to avoid increase in stream temp.		
7i	No logging slash/debris disposed from outside of strip into strip.		
7j	% excessive rutting avoided: 6 inches deep and 25 foot long in RMZ, 12 inches deep and 50 feet long in other areas.		
7j	% of Rutting in RMZ- check one box		<input type="checkbox"/> <25% <input type="checkbox"/> 26-50% <input type="checkbox"/> 51-75% <input type="checkbox"/> >75%
7k	Streams, lakes, open-water wetlands free of slash.		
7l	Located roads, landings and skid trails outside strip where possible.		
7m	Cuts, fills, roads stabilized if present.		
7n	Limbs and tops within RMZ left on ground.		
7o	Vernal ponds protected from rutting and buffered.		
7p	Soil compaction and scarification avoided.		

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

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)

Rate this site for its overall impact to water quality
severe, moderate, slight, negligible, or no impact _____

8. Training needs identified:

Great example of a well planned site. _____

Exhibit 8

BMP Question Analysis and Comparison



Table 1

BMP Applied Correctly (A) or Acceptable Variation (V) on More Than 75 Percent of Sites			
Questions Answered as Acceptable for >75 Percent of Sites in Both 2015 and 2016.	Question ID	No. of Sites Coded A	No. of Sites Coded V
Landings: Re-vegetated/stabilized/leveled as needed	6f	199	0
Equipment Operation and Maintenance: Provided for adequate storage and disposal of fuel, debris, lubricants, fluids, and rinsate from equipment cleanup.	1b	198	1
Landings: Provide for adequate drainage.	6b	198	0
Other: Harvesting is timed for appropriate conditions and operations minimize rutting and compaction damage.	9d	187	3
Skidding and Trails: Excessive rutting avoided: 6 inches deep and 25 feet long in RMZ, 12 inches deep and 50 feet long in other areas.	5f	184	3
Landing and/or Decking Areas: Erosion control features functional, no movement of soil from the landing area.	6e	179	0
Skidding and Skid Trails: Gullies, seeps and other permanently wet areas avoided where feasible.	5d	174	4
Other: Site preparation and reforestation practices minimize soil disturbance, follow land contours, recognize RMZs, and avoid soil erosion.	9c	170	1
Roads: Excessive rutting avoided on the road: 6 inches deep and 25 feet long in RMZ, 12 inches deep and 50 feet long in other areas.	2b	167	2

Table 2

BMP Applied Correctly (A) or Acceptable Variation (V) on More Than 75 Percent of Sites			
Additional Questions Answered as Acceptable for >75 Percent of Sites in 2016.	Question ID	No. of Sites Coded A	No. of Sites Coded V
Road Closure and Retirement: Erodible soils stabilized by seeding, natural vegetation or brush.	3d	167	0
Landing and/or Decking Areas: Drain surface water into buffer strip or vegetation and logging residue does not enter water bodies.	6d	164	0
Skidding and Skid Trails: Drain surface water into buffer strip or vegetative draw with energy dissipaters as needed.	5c	162	0
Roads: Roads follow contour with grades between 2 and 10 percent. Grades exceeding 10 percent do not exceed 300 feet in distance.	2l	161	0
Roads: Obstacles: avoid gullies, seeps, springs, wetlands, and poor drainage areas where possible.	2i	161	0
Skidding and Skid Trails: Rehabilitate skid trails as needed.	5h	161	0
Landing and/or Decking Areas: Proper water diversion devices in working order.	6c	155	0

Table 3

BMP Applied Correctly (A) or Acceptable Variation (V) on Less Than 10 Percent of Sites				
Questions Answered as Acceptable for <10 Percent of Sites in Both 2015 and 2016	Question ID	No. of Sites Coded A	No. of Sites Coded V	No. of Sites Coded NA or 0
RMZs: State Natural River Plan or Wild and Scenic River Plan followed and permit obtained.	7b	0	0	200
Wetlands: Permit obtained for culverts, bridges, or construction in floodplains > 2 sq. miles.	8c	0	0	200
Cross streams at right angles.	4c	0	0	200
Wetlands: Non-forestry construction does not occur without a Part 303 permit from DEQ.	8b	0	0	200
Stream Crossing: Stream crossing permit obtained and followed.	4b	1	0	199
Equipment Operation and Maintenance: Spills are cleaned up. If DEQ reporting threshold is met, then spill was reported.	1c	1	0	198
Other: Archeological sites are protected if known to be present.	9a	4	0	195

Table 4

BMP Applied Correctly (A) or Acceptable Variation (V) on Less Than 10 Percent of Sites				
Additional Questions Answered as Acceptable for <10 Percent of Sites in 2016.	Question ID	No. of Sites Coded A	No. of Sites Coded V	No. of Sites Coded NA or 0
Stream Crossing: Culverts properly armored if needed.	4h	1	0	199
Water diversion ditches installed properly.	4m	1	0	199
Stream Crossings: Energy dissipaters at cross drainage and/or stream culvert outlets where necessary.	4p	2	0	198
Stream Crossings: Cross drainage culverts properly sized (min. 12 inches) and installed.	4n	2	0	197

Table 5

BMP Questions Receiving Applied Incorrectly (1) or Not Applied (2)			
Questions Answered as Not Acceptable for Sites in Both 2015 and 2016.	Question ID	No. of Sites Coded 1	No. of Sites Coded 2
Skidding and Skid Trails: Excessive rutting avoided: 6 inches deep and 25 feet long in RMZ, 12 inches deep and 50 feet long in other areas.	5f	6	6
Skidding and Skid Trails: Rehabilitate skid trails as needed.	5h	0	9
Road Closure: Erosion control features functional.	3c	3	6
Roads: Water diversion ditches installed properly.	2e	2	4
RMZs: Excessive rutting avoided: > 6 inches deep and 25 feet long.	8d	1	3
Skidding and Skid Trails: Water bars properly installed as needed.	5b	1	2
Skidding and Skid Trails: Gullies, seeps, and other permanently wet areas avoided where feasible.	5d	0	3
Roads: Cross drainage culverts properly sized (min. 12 inches) and installed.	2f	1	1
Other: Harvesting is timed for appropriate conditions and operations minimize rutting and compaction damage.	9d	1	1
Roads: Drain surface water into filter strip or vegetative draw.	2g	0	2

Table 6

BMP Specifications Receiving Applied Incorrectly (1) or Not Applied (2) Coding			
Additional Questions Answered as Not Acceptable for Sites in 2016	Question ID	No. of Sites Coded 1	No. of Sites Coded 2
Roads: Broad base dips installed properly.	2d	2	7
Roads: Crown road on sections crossing level ground or low areas.	2c	3	2
Road Closure: Water bars properly spaced and installed where slope of road requires and where temporary cross drainage culverts were removed.	3b	0	5
Road Closure: Erodible soils stabilized by seeding, natural vegetation or brush.	3d	0	5
Road Closure: Properly close and/or sign abandoned or infrequently used roads.	3f	0	3
Landing and/or Decking Areas: Drain surface water into buffer strip or vegetation and logging residue does not enter water bodies.	6d	1	1
Wetlands: Wetland crossings include placement of culverts and other structures to ensure adequate water flow and drainage.	8e	0	2
Other: Rare, threatened, and endangered species are protected, if present.	9b	0	2
RMZs: Buffer strip clearly established.	7c	0	2

Exhibit 9

Supplemental Questions and Responses



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

- Protect rare plant, fix and repair roads
- Gated roads
- Rutting was minimized in lowland area by proper timing
- Newly constructed roads followed contours
- Well established buffer along a major river
- Used water bars on haul roads with terrain
- Established quality buffer along stream, no rutting across entire sale
- Buffer on trout stream is effective even though it doesn't follow exact guidelines
- Avoided lowland areas
- Adequately buffered stream and corduroy utilized for floatation in wet areas
- Bermed roads correctly and established RMZ correctly
- Left larger than needed RMZ
- Harvest in cedar stand had good slash mat and no rutting resulted
- Adequate buffers and avoidance of trout stream
- Limited BMP issues
- Adequately buffered wetland
- Proper buffer along trout stream
- Soil and water quality not impacted, despite flawed buffer
- Well timed harvest to avoid damage to wet soils
- Roads and skid trails outside of RMZ
- Bermed roads successfully keeping ATVs out
- Winter harvest minimized impacts to soil, roads, and skid trails
- Proper RMZ width
- Removed temporary culverts and bridge after harvest
- Road closure and seeding of skid trail
- Closed road and avoided wetland
- Roads successfully closed
- Protection of archaeological site, RMZ around lake
- Road was graveled as needed and harvest boundary placement with special consideration to wetlands
- Proper buffers on streams
- Had a large buffer for creek
- Utilized a 45-foot buffer around a small fen
- Roads stabilized
- Removed slash mat from stream crossing after the harvest

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

- Everything done well except for movement of sand downhill on road
- Timber sale over 450 feet from water feature, retention of trees and groups of trees, checked for and managed historical resource
- Good buffer along the stream
- Blocked off skid trails to use of after completion
- Kept slash out of adjacent wetlands, roads stabilized well, and road closure practices were above standard means
- A < 20 foot buffer applied to wetland on harvest boundary, following natural contours
- Adequate buffer along creek
- Slash piled on main road to prevent vehicle use on the sale
- RMZ identified clearly and didn't have to create new roads for the sale
- Blocked main skid trail with brush to avoid unwanted use
- Appropriate season for harvest, adequate buffer from river and stream
- Woods roads naturally re-seeded
- Avoided wet areas, no rutting, used limbs for flotation
- Proper harvest timing and drove on tops
- Avoided low areas, no rutting on skid trails or roads
- Avoided lowlands and preserved quality road system
- Water bars installed on slopes are working
- Roads rehabilitated, buffers installed and followed, no rutting
- More than adequate lake and wetland buffer
- Avoided lowland area
- Pulled slash out of drainage
- Water diversion ditches
- No ruts
- Avoided lowland areas and seeded roads
- Left buffer area
- Roads are vegetated
- Adequate buffer of multiple water features
- Avoided low areas
- Seeding of trails and landing, after winter harvest
- Obtained proper permitting with DEQ, bermed unused roads
- Well vegetated roads
- Revegetated skid trails
- No erosion

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

- Avoided lowland wet areas
- Kept slash out of wetland
- Properly closed roads and reseeded/repared ditches by roadside landing
- Harvest was away from wetlands, skid trails and roads were allowed to reseed to prevent erosion, no rutting
- Seeding of trails, good timing of harvest
- Seeded trails, put fill on low areas of road, and excellent ditching
- Roads and skid trails follow contours, no ruts
- Slashed was used to prevent significant rutting, wetlands were avoided when possible
- Extra work put into road stabilization
- Harvest timed properly, maintained wetland and lake-buffer properly, and skid trails rehabilitated where needed
- More than adequate buffer, timing of harvest was appropriate
- Left cedar along stream, winter harvest, and trails rehabilitated
- Road seeding, slash kept in wetlands when needed, no rutting, and water diversion ditches well done
- Blocked access with logging debris.
- Cleaned skid trail and followed contours
- Avoided and adequately buffered trout stream
- Used hand felling crew, maintained clear buffer
- Rehabilitated and revegetated skid trails
- Roads follow contours
- Seeded trails and no ruts
- Avoided drainage ditch
- Maintained shading of ditch and no rutting
- Avoided raptor nest
- Winter harvest, an attentive landowner and consulting forester
- Avoided river
- The landowners and foresters worked with the logger to avoid wet areas.
- This site is a small-scale managed wood lot. The owner cuts and skids the trees himself. Impacts of harvesting equipment are virtually nonexistent
- Proper road closure
- Proper seasonal timing and only crossed drainage ditch in one spot
- Avoided wetland even though timber on other side was designated to be cut, (did not cross wetland to get it)

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

- Avoided wet area from harvesting and skidding, and properly closed and ditched road
- Avoided ditch, timed right
- Crowned roads to have some water diversions.
- Avoided low areas and seeded trails
- Planted where it could be planted.
- Maintained buffer strip and did not lay slash in ditch area
- Avoided raptor nest and lowland areas. New roads were crowned
- Roads and skid trails properly rehabilitated
- Proper timing and reseeded landing
- Proper timing, no ruts
- Buffer along stream clearly established, properly timed harvest, and no ruts
- Left adequate buffer around lake, no ruts
- Avoided swamp and seeded landing; all things went right on this site

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

- Diversion ditches would have prevented pooling of water on road, which had to be fixed
- Harvesting during wet conditions resulted in rutting throughout the stand
- Rutting, though infrequent and in a larch area which needed to be skidded through, was present
- Small diesel spill needed to be cleaned, though there was no threat to water quality
- Open water wetland lacked clearly delineated buffer strip. However, harvest avoided water by following natural contour of land.
- Erosion of soil on the road could have been avoided with the installation of water bars and/or diversion ditches
- Rutting in wetlands
- Few small ruts and compaction
- No clearly defined buffer along trout stream
- Road needed crowning in areas crossing flat spots
- Slight rutting in low-lying areas and berms meant to prevent access were pushed aside
- Road poorly drained
- Road needed water diversion structure
- Minor rutting on skid trails
- Excessive rutting not corrected. Lack of needed water bars.
- Water bars needed to be larger and more angled to prevent water from flowing over and eroding soil

4. What things went wrong on this site? (Summarize problems) - Continued

- Post-harvest use of one road leading to erosion into beaver area, flooding and rutting.
- Cross drain culverts undersized and erosion on road which water bar installation would have prevented
- Rutting and skidding through low lying areas
- Should have waited for ground to freeze
- Some soil compaction not deep enough to be ruts
- Could have used more slash to limit rutting in soft areas
- Pushed landing material into wetland
- Excessive rutting in wetland
- Improved trail impounds wetland, minor rutting
- Logger put treetops in adjacent wetland
- Road needed water bars and water was eroding soil downslope
- Rutting in a low area
- Water ponding in landing
- Rutting in low area and stream disturbance via road crossing
- Main skid trail should have had water bars installed or have been bermed to prevent use
- Erosion on roads and skid trails is excessive and could have been prevented with water bars and/or seeding
- Some cross drain culverts that existed, could have been installed better

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

- Berms, buffered lakes and wet areas
- Adjacent harvest adding to road activity
- Road work is currently taking place on the site
- Adjacent landowner using skid trails for recreational use
- ATV use is rutting up road
- ATV use, but no problems
- ATV use
- Access road has potential to be impacted by neighboring landowners
- ATV and truck use on roads
- ATV use has potential to increase erosion into the fen
- ATV use and camping at landing
- ATV use for recreational purpose
- ATV use had effect on soil, roads, and landings

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

- ATV use on roads
- ATV use on the roads did not affect water.
- Heavy recreational use to access the lake in addition to horse and ATV use.
- ATV trail, however no water quality concerns.
- ATVs use, however the trail system was used so there is no affect to water quality
- Large part of harvest area stumped and converted to food plot (appears is raising water table) and ATV use from landowner is leaving shallow rutting. Should limit ATV use during wet periods
- It appears the landowners are building new road in the wetland area, though dozer is still present so they may not be finished building proper drainage structures
- ATV use by stream and also excavation being done in stream by landowner, not related to forestry operations
- Access to other properties is making road muddy and could eventually rut
- Skid trails turned into ATV trails. Soil pulled from site, even in wetlands to put on road. Soil quality not affected by this
- Rutting on road post-harvest and cabin traffic
- ATV/pickup traffic is frequent enough to continuously erode soil
- Farming traffic across stream on road
- We assessed the timber sale the best we could. Due to wildlife habitat and site prep work that the landowner has conducted. We had to make some assumptions. The landowner made some large changes
- ATV use across wetland
- Roads used in wet conditions after timber sale. Due to the water channeling from this use, we concluded crowning/diversion ditches should have been applied to the road in some locations. The gates look newly installed so this might help with unwanted traffic on the road

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

- No, rutting was not resulting in erosion or sedimentation
- Spill is going to be cleaned up as gravel is removed from pit
- Could return to site to install dips or diversions
- None, more damage than good would come of repairing ruts
- Water bars should be installed to prevent road surface soil from being washed away
- Road should be bladed and water bars installed
- Control ATV use, though signage is currently established
- Water diversion device on main road may help mild erosion
- Close the road
- Place water bar or increase seeding on road
- Landowner has seeded in bare soil roads
- Should back blade ruts that occur in wetland
- Cross drain, culverts should have been installed on main haul road accessing the site
- Water is impounding on both sides of the road
- Install cross drain structures in wetland road
- Install water bars
- Revegetate landing
- Permanent bridge should be installed
- Not for harvest activities

8. Training needs identified:

- Timing of harvest
- Verify close out procedures to mitigate issues
- Landowner set up sale on his own. He would have preferred a professional do it, though the last harvest set up on the property by a forester did not turn out well in his opinion
- Landowner interest in invasive species control for phragmites
- Landowner complained of harvest operations being messy and chipping was supposed to happen but it was done at a later time
- Proper stream crossing

Exhibit 10

Photographs





Foresters taking measurements to determine if a rut is present in a wetland.



The red paint on the tree above marks a buffer protecting a lake from a timber harvest.



This forest road was bermed following harvest to prevent vehicle entrance to the timber sale area.



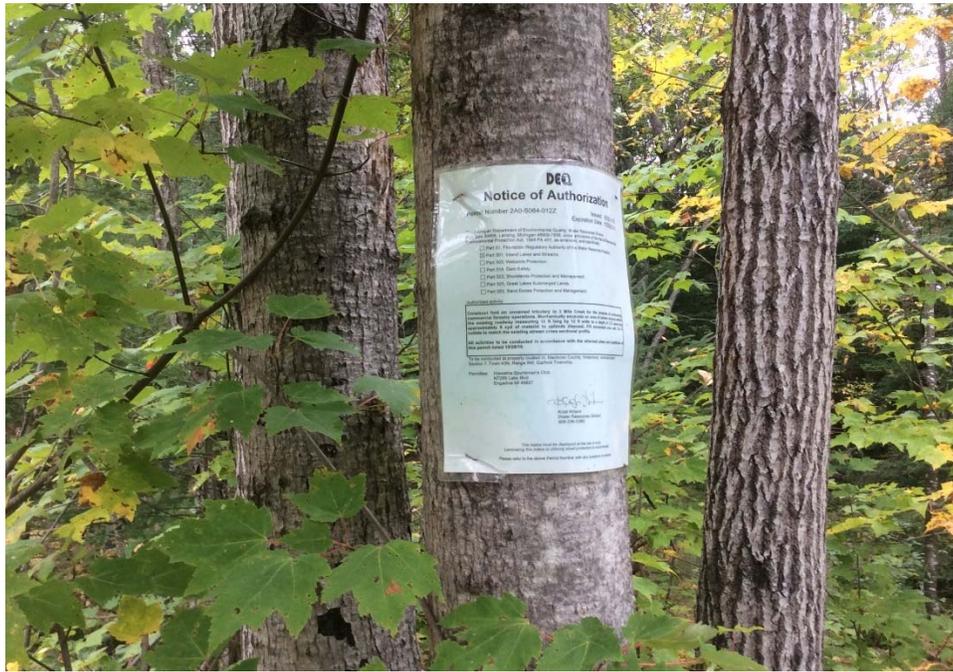
Ruts occurring in a forested wetland are shown above.



The above photo shows standing water in a landing area used to deck forest products during an active timber harvest.



This photo demonstrates a properly stabilized forest road. Water bars and road seeding were two effectively utilized BMPs.



DEQ permit obtained and placed near the site requiring BMP work.



Slash used to prevent rutting in a wetland above has not been removed from the site, but did successfully prevent rutting in the sensitive area.



A forest road with erosion near a beaver pond.



A properly installed cross drain culvert.

Exhibit 11

All Regions Summary –
Acceptable and Unacceptable
BMP Applications



Table 1

BMP Questions Most Often Receiving Applied Incorrectly (1) or Not Applied (2) (All Regions)			
Questions Answered as Not Acceptable	Question ID	No. of Sites Coded 1	No. of Sites Coded 2
Skidding and Skid Trails: Excessive rutting avoided: 6 inches deep and 25 feet long in RMZ, 12 inches deep and 50 feet long in other areas.	5f	10	10
Skidding and Skid Trails: Rehabilitate skid trails as needed.	5h	1	13
Road Closure: Erosion control features functional.	3c	4	7
Roads: Broad base dips installed properly.	2d	2	7
Roads: Water diversion ditches installed properly.	2e	3	6
Skidding and Skid Trails: Water bars properly installed as needed.	5b	2	6
Roads: Cross drainage culverts properly sized (min. 12 inches) and installed.	2f	4	3
Roads: Drain surface water into filter strip or vegetative draw.	2g	2	5
Skidding and Skid Trails: Gullies, seeps, and other permanently wet areas avoided where feasible.	5d	2	5
RMZs: Excessive rutting avoided: > 6 inches deep and 25 feet long.	8d	2	5

Table 2

BMP Questions Most Often Receiving Applied Correctly (A) or Acceptable Variation (V) (All Regions)			
Questions Answered as Acceptable	Question ID	No. of Sites Coded A	No. of Sites Coded V
Equipment Operation and Maintenance: Provided for adequate storage and disposal of fuel, debris, lubricants, fluids, and rinsate from equipment cleanup.	1b	296	1
Landings: Provide for adequate drainage.	6b	296	0
Landings: Re-vegetated/stabilized/leveled as needed	6f	295	0
Other: Harvesting is timed for appropriate conditions and operations minimize rutting and compaction damage.	9d	284	3
Skidding and Skid Trails: Excessive rutting avoided: 6 inches deep and 25 feet long in RMZ, 12 inches deep and 50 feet long in other areas.	5f	274	4
Landing and/or Decking Areas: Erosion control features functional, no movement of soil from the landing area.	6e	274	0
Skidding and Skid Trails: Gullies, seeps, and other permanently wet areas avoided where feasible.	5d	267	4
Roads: Excessive rutting avoided on the road: 6 inches deep and 25 feet long in RMZ, 12 inches deep and 50 feet long in other areas.	2b	266	2
Skidding and Skid Trails: Rehabilitate skid trails as needed.	5h	261	2
Landing and/or Decking Areas: Drain surface water into buffer strip or vegetation and logging residue does not enter water bodies.	6d	259	0

Exhibit 12

Qualifications



**Qualifications of
Laura B. Heier
Private Forest Management Operations Director**

Education: University of Wisconsin – Stevens Point, 2009
Bachelor of Science, Forest Management and Urban Forestry

Employment Period: September 2010 to present

Experience:

Timber Sales, Preparation, and Administration: Performs all aspects of timber sale administration including initial consultations, timber sale contracts, and record keeping, as well as supervising logging, trucking, and timber marking operations.

Forest Management Planning: Experience in preparing and implementing sustainable forest management plans for private landowners. Works with clients to enroll Wisconsin lands into the Managed Forest Law (MFL) program and assists with program compliance.

GIS, Forest Mapping, and Aerial Photo Interpretation: Skilled in aerial photography interpretation and analysis, as well as in the use of ArcGIS software for day-to-day forest management operations.

Forest Inventory: Experienced in check cruising for due diligence operations, as well as forest inventory, timber sale, and general management purposes.

Best Management Practice (BMP) Monitoring: Oversee and organize the implementation of BMP field monitoring in Minnesota (2014-2015 monitoring years). Coordinated the development and execution of BMP monitoring in Michigan (2015), including site selection, landowner contacts, site inspections, field training, data evaluation and report writing.

Appraisals: Assists Certified General Appraisers in all aspects of appraisal work, including writing appraisals, tax research, collecting zoning and other additional background information, inspecting properties, and gathering supporting documentation. Attending educational courses in pursuant to attain appraiser's license.

Memberships and Certifications:

Society of American Foresters (SAF)
Forestry Commercial Pesticide Applicator
Wisconsin DNR Certified MFL Plan Writer
Association of Consulting Foresters (ACF) – Candidate Member

**Qualifications of
Forrest M. Gibeault
Analysis and Investment Operations Director**

Education:

Michigan Technological University, 2005
Master of Forestry

University of Wisconsin–Green Bay, 2004
Bachelor of Science, Environmental Science, Physical Systems

Employment Period:

2006 to present

Experience:

Appraisals / Market Analysis: Preparation of timber appraisals and stumpage analyses for a variety of clients. Specialized in developing forestland valuation metrics and analyses, as well as the analysis of timber market information.

Forest Inventory: Supervises inventory operations, with extensive experience in forest inventory methods, inventory design, and statistical data summary and analysis. Also responsible for the application of field computers and forest inventory technology, including *TCruise* timber inventory software for cruise template design and volumetric processing. Experience includes cruises for state, federal, and industrial clients, with projects developed for forest management and planning, and timberland sales and acquisition. Experienced developing inventory protocol and plot arrangement for carbon offset projects.

Forest Management: Responsible for developing forest management plans for private and industrial landholders, with expertise in the development of forest tax law plans in Wisconsin and Minnesota. Expertise in Wisconsin forest tax law policy and land management applications. Responsible for overseeing the ongoing management of large non-industrial private forestland blocks.

Forest Data and Resource Analysis: Responsible for the acquisition, summary, and analysis of stumpage data, timber industry market data, and Forest Inventory and Analysis (FIA) data. Extensive experience developing resource analysis studies and facility sighting projects across the United States. Experience also includes analyzing inventory data with stand and individual tree modeling software (FVS and North Pro) including custom FVS modeling for carbon project analysis through various forest management approaches.

Forest Land Acquisition and Sales: Experienced in analyzing detailed forest data for acquisition and sales, including statistical analysis and data summary, market analyses, and timber/stumpage price analysis. Advises clients by analyzing forestland for sale and acquisition.

GIS and Aerial Photo Interpretation: Experience includes the use of ArcGIS software for forest data analysis, inventory processing, and day-to-day forest management needs. Proficient at interpreting digital and aerial photography for a variety of forest management applications.

Memberships and Certifications:

Society of American Foresters – Since 2006
Wisconsin DNR Certified MFL Plan Writer – CPW No. 083
Association of Consulting Foresters

**Qualifications of
Joseph P. Salm
Forest Analyst Assistant**

Education: University of Wisconsin–Stevens Point, 2015
Bachelor of Science, Forest Management
GIS Professional Certificate in Forestry

Employment Period: December 2014 to present

Experience:

Forest Inventory: Experienced in forest inventory fieldwork, planning, and management in multiple regions of the country. Assists in inventories for land transactions, carbon credit assessment, forest cover mapping, and timber sale establishment. Proficient with the use of handheld computers and GPS applications. Skills include the use of tablet-based data collection software, managing large datasets, T-Cruise inventory processing, pre-cruise setup, post-field processing, and inventory data analysis.

Timber Sale Establishment: Experienced in silvicultural practices utilized in the Lake States region, as well as timber sale boundary establishment and timber marking.

GIS/Data Analysis: Responsibilities include the application of GIS analysis using ArcMap to complete custom analysis, database maintenance, and map creation.

Stumpage Valuation: Experienced in gathering and analyzing stumpage information for valuation projects and forestland management.

Resource Analysis: Assists senior staff with the acquisition, summary, and analysis of timber industry market data, Forest Inventory and Analysis (FIA) and Timber Product Output (TPO) data, and other relevant statistical datasets for project analysis.

Licenses and Memberships:

Society of American Foresters
Wisconsin DNR Certified MFL Plan Writer

Qualifications of Robert J. Anderson Forest Analyst Assistant

Education: University of Wisconsin – Stevens Point, 2009
Bachelor of Science, Forest Management
GIS and Spatial Analyst Minor

Employment Period: January 2013 to present

Experience:

Forest Inventory: Broad experience completing forest inventory fieldwork and summarizing information for forest planning, land transactions, mapping, and timber sale establishment. Assists in cruise planning and design, along with implementing field procedures. Leads and organizes field projects, including managing individuals and teams to ensure quality and efficient work. Experienced with forest inventory data processing including TCruise desktop and handheld software. Knowledgeable with the application of field computers and inventory software, assisting in troubleshooting and training.

Forest Management: Experienced in writing state management plans using Lake States silvicultural practices. This includes implementing fieldwork, working with the landowner to achieve their goals, and meeting the program guidelines. Experienced in auditing timber sales for Best Management Practices. Skilled in timber sale establishment, timer marking, and administration.

Data Analysis: Experienced in analyzing and summarizing forest inventory data. Works with analyzing and tracking stumpage data, along with using data to create timber appraisals. Assists in acquisition due-diligence work, as well as resource analysis projects.

GIS: Education and experience using ArcGIS software, handheld computers, GPS, and web mapping applications. Work includes desktop analysis and mapping projects, along with creating and maintaining databases and shapefiles.

Tree Care: Experienced in treating ornamental trees for diseases and pest problems and in using herbicides as a control. Possesses the knowledge and skills to work through diagnosis and treatment options or techniques.

Licenses and Memberships:

Society of American Foresters
Wisconsin DNR Certified MFL Plan Writer
Wisconsin DATCP Certified Pesticide Applicator, Categories 2, 3
Wisconsin DATCP Licensed Individual Commercial Pesticide Applicator