Wisconsin's Forestry Best Management Practices (BMPs) For Water Quality

2018 BMP Monitoring Report




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Acknowledgments

This report would not be possible without the help of many individuals and organizations; we would like to thank them for their time commitments and hard work:

- The state and county foresters who took time out of their work schedule to help provide the BMP monitoring teams with additional information on the review sites. This additional information was vital and allowed our teams to understand exactly how BMPs were applied to each individual site.
- The BMP monitoring teams who evaluated sites all over Wisconsin in a variety of weather conditions. The team leaders who put in extra time handling their team and external logistics to make all the monitoring efforts run as smoothly as possible.
- External companies and internal DNR supervisors that let their employees take part in volunteering for monitoring efforts and give up three days of their employee's time.
- Laura Reuling and Dustin Bronson, DNR Forest Scientists who helped write and compute statistical analyses on BMP data to ensure valid sample sizes and accurate results.
- The BMP Advisory Committee for their interest in Wisconsin's Forestry BMPs and for their guidance in developing a successful BMP monitoring program.

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PUB-FR-909 2021

Printed on Recycled Paper

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Executive Summary

In the fall of 2018, state lands and county forests were monitored for the application and effectiveness of Wisconsin's Forestry Best Management Practices (BMPs) for Water Quality. State lands had 38 sites selected for monitoring, and county forests had 34 sites. These sites were chosen because of the water resources in or adjacent to the sale. Information on how the BMPs were implemented and how effective they were, was recorded along with site information such as: sale size, season of harvest, water resources, forest roads and tree species of the harvest area.

County

There was a total of 2,604 acres monitored over the 34 sales, which calculates the average acreage to be 76.6 during the 2018 BMP monitoring cycle. Winter was the most common season of harvest utilized on county forest lands, with 10 sales undergoing winter-only harvests and eight sales being cut in both in with winter and another season. Aspen was the most dominant timber type listed, at 19 sites, whereas, bottomland hardwoods was the least common at only two sites.

The most common water resource was wetlands, where every site monitored had wetlands bordering, crossing, or adjacent to their harvest area. Streams were also common with 23 sites listing them as a water resource. Only six lakes were recorded as being adjacent to sale areas. For water resources that recommended an RMZ, Seventy-four percent either met the minimum distance or expanded on the minimum distance. Seven sites contained stream crossings on their forest road system, where all but one was crossed using culverts as the crossing structure. More diversity was observed for crossings structures in the five stream crossings observed on the skid trail system. There were many forest road systems in place, 31 out of 34 sites had forest roads and 25 of those sites had them listed as active forest roads. Flat and at grade were the most common forest road design and construction. Lastly, severe weather was recorded by the monitoring teams for over half of the county sites, which is an increase by over 300% from 2013.

All the water features led to high rates of BMPs being applicable to the county sites. On average, 35.8% of BMPs were applicable to each site. Of those applicable, 90.7% were *applied correctly*, which is a slight drop from 93% *correct application* observed in 2013. BMPs were *not applied* where they were needed at 7.5% of the time. *Correct application* was again variable over the five different monitoring categories, where "Fuels, Waste and Spills" along with "RMZs" received a very high *correct application* rate, both at 98.5%. This in very different from the 81.9% *correct application* rate observed for "forest roads."

The effectiveness for protecting water quality remains exceptionally high when BMPs are used correctly at 99.9%. Four of the five monitoring categories received 100% effectiveness when BMPs are used correctly. When BMPs are *not applied* correctly, however, adverse impacts to water quality are observed 71.6% of the time. Both effectiveness rates are similar to those found in 2013. There were no *major-long term* impacts found on county land during 2018 BMP monitoring.

State

There was a total of 3,577 acres monitored over the 38 sales, which leads to the average acreage of 94.1 for state lands during 2018 BMP monitoring. Ten of those sales were harvested solely during winter months and 14 more sales were cut partially during winter, which was the most common combined harvesting season, but only marginally ahead of the fall season. The most common dominant timber type listed for sites was aspen, at 22 sites and the least common was swamp conifers, at only one site. Five of the sales were partially restricted due to water quality concerns and a little over one-third (14 out of 38) of the sites had seasonal restriction on the entire sale. Exactly half of the sites had no seasonal restrictions from water quality concerns.

The most common water resource was wetlands, with all but two sites having them listed as a water resource. Streams were the second most common water resource, with 23 sites containing or bordering streams. RMZs widths on streams and lakes were increased on 13 sites and met the minimum distance on 18 sites. Only five of the sites contained stream crossings on their forest road system, but eight sites crossed streams on skid trails. Frozen/ice crossings were listed as the most common stream crossing structures for these skid trail crossings.

Thirty-four of the 38 sites had forest roads present, with over 2/3 of the sites (24/34), contained active forest roads. Forest road design on state land was most commonly flat, which was the primary design for 28 sites out of the 34 sites. Road construction follows a similar story to road design because almost all the sites fall into one category, in this case, 25 sites are listed as “at grade.” Severe weather was also on the uptick for state sales, where 18 of the sales were listed as having severe weather present from the time between timber sale set up and BMP monitoring.

Overall, teams discovered that 34.5% of BMPs were applicable to state lands and when they are applicable, 97.2% of the time, they are *applied correctly*. Only 2.3% of the time was a BMP applicable to the site and was *not applied*. Like in past years, along with other landowners, different monitoring categories have different rates of *correct application*. The monitoring category of “fuels, waste, and spills” had the highest at 100% and “forest roads” received the lowest *correct application* rating at 93.6%. Overall, *correct application* rates in 2018 are over 10% better from the baseline data in 1995-1997.

BMP effectiveness for the state when correctly applying BMPs was high at 99.6% overall. Only two monitoring categories did not receive 100% effectiveness rates when BMPs were *applied correctly* – “wetlands” and “timber harvesting.” Water quality was impacted nearly 70% of the time when BMPs were *not applied* where they were needed. There was only one *major long-term* impact found on state land during BMP monitoring.

2018 BMP Monitoring Sites Map

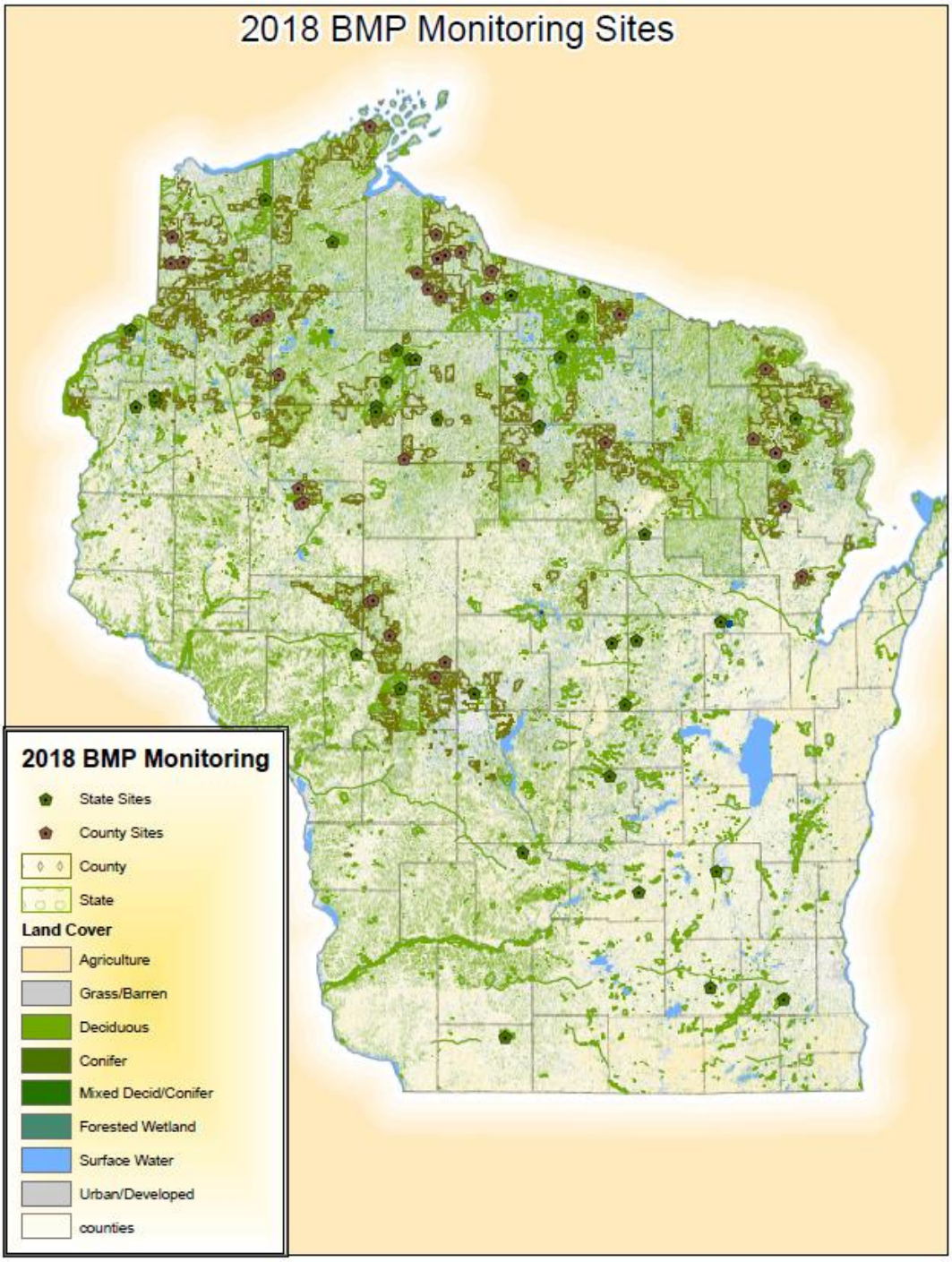


Figure 1. **The sites monitored by the 2018 BMP teams. Tan dots represent county sites and green dots represent state sites. Note: Some dots are close together making the total number of sites difficult to determine on this map. Disclaimer: *The Department has made reasonable efforts to provide you with accurate information but cannot exclude the possibility of errors or omissions in sources or of changes in actual conditions. The Department makes no warranties of any kind, either the express or implied. Changes may be periodically made to the information herein. ***

Introduction

Since the Federal Clean Water Act was originally passed in 1972, several revisions have been made and now include the specific activities of silviculture and its contributing factors to nonpoint source pollution (NPS). Each state is required to develop either guidelines or regulations to reduce the NPS from silviculture to the "maximum extent practical." In Wisconsin, this has led to the development of the Best Management Practices (BMPs), which are designed to protect water quality – from silvicultural activity – according to the Clean Water Act of 1972 and its following revisions.

Wisconsin adopted the BMP program in 1995, and through monitoring, statistical analysis, and written reports, Wisconsin can document its success in protecting its water quality through the BMP program. Initially, all silvicultural activities done within the state of Wisconsin were subject to being monitored every year. There are many different landowners that reside over the forests of Wisconsin including: Federal, Industrial (Large), County, State, Non-Industrial Private (NIP), and Tribal landowners. With this many landowners, monitoring a statistically valid sample size from each proved to be too demanding of a task and the BMP Advisory Committee (comprised of individuals who represent many different interests in Wisconsin's forests) decided to only monitor one or two landowners on any given year.

The landowners monitored in the fall of 2018 were county and state. Both landowners conduct commercial timber harvests on multi-use properties – meaning that there are often different goals and objects on any one given piece of property besides producing a forest product. Some examples of this is state wildlife areas, which emphasis may be for primarily hunting, or properties with ATV or snowmobile trails contained within them. Both these landowners go through extensive property planning processes and coordination with the public so that lands owned by the state and county can satisfy the expansive needs of different recreation groups while maintaining a key Wisconsin natural resource – forest products. Besides not running afoul with EPA guidelines and third-party certification for the responsible harvest of a forest product, BMPs are implemented throughout a timber harvest to enhance the ecological function of the state's waterways and wetlands. Supporting these ecological functions, in turn, helps to support and improve the recreational value of the land managed by the state and county.

This year, there were 583 sales on county lands and 234 sales on state lands that were eligible for BMP monitoring for the 2018 monitoring cycle. All sales that were financially closed out during the calendar year of 2017 were initially eligible for BMP monitoring. To achieve a 95% confidence interval (see Appendix A), it was determined that 39 sales from the state would need to be monitored and 32 sales from the county would need to be monitored. The number of sales monitored was 38 (one less) for state lands and 34 (two more) sales for county lands. Data from previous monitoring years are used to determine the number of sales needing to be monitored along with the current years sample size. This is how there were more sales on county lands initially eligible than on state lands, but state lands need more sales included into BMP monitoring to achieve the 95% confidence interval. After the initial list of sales are made, sales are randomly selected then examined to see if they are eligible to be monitored using both computer satellite imagery and by field checking the potential sites. Sites that are chosen to be monitored must meet at least one of the eligibility criteria:

- Harvesting completed within 200 feet of a lake, river or steam
- At least one acre of wetland harvested
- A significant length of wetland crossed (≥50 ft.)
- A stream crossed

This ensures that the BMP program, through the monitoring teams, will be focusing its time at timber sales that can potentially have the most impact on water quality. Sites that lack any of these characteristics are unlikely to impact water quality in a direct (observable) manner.

The BMP monitoring teams are comprised of individuals (usually four to six) who have a wide background of expertise ranging from hydrology, soil science, ecology, conservation, silviculture and logging. Volunteers are asked to participate in BMP monitoring through organizations such as the DNR, County Forest Program, US Forest Service and other groups are asked through the BMP Advisory Committee. To achieve consistent evaluations across all the different sites, there were trainings held for all the teams, put on by the DNR Forest Hydrologist and the DNR BMP Forester. These trainings included both lecture/discussion in a classroom type setting and field portions where everyone went to sites to go through the monitoring worksheets together. Information about the site was collected as well as being evaluated for the application and effectiveness of BMPs.

Timber Harvest Information

Harvest Age

All the sales monitored during the 2018 BMP efforts were closed between January 1st, 2017 and December 31st, 2017. Although the sales were closed during this time, the actual time between when the sale was harvested and when it was monitored may vary. Sales are monitored the following year from when they are closed for several reasons:

- The sale will have gone through at least one runoff season (spring)
- The sale will no longer be active (safety reasons and not hindering logging operation)
- Evidence of logging activity will still be fresh and easy to see and evaluate

This leads to an observation variable called *harvest age*. Harvest age is determined by two methods: the most sure-fire way the monitoring teams found out sale age was by asking the timber sale administrator. The other way for teams to determine harvest age is to look at the growth of the trees within the sale. When teams looked at growth to determine harvest age, this would make sales starting age in the Spring season – when the new flush of vegetation growth occurs. This would make a sale harvested in the fall (after growing season) be marked down as the same age as a sale cut during the late winter or early spring. This causes harvest age to be more relative than absolute, plus more ranged than precise, which is why the categories are broken down into ranges.

County

The majority of sites (21 out of 34) were cut "1-2 years" prior to monitoring and had roughly one-quarter (8 out of 34 sites) cut "more than two years" prior to BMP monitoring (Figure 2). There were only five other sites harvested outside of these two time slots, with two sites being harvested in "multiple years" and three sites having their harvest age "unknown."

State

State sites had extremely similar ratios as county sites, with 25 sites being harvested "1-2 years" prior and 10 sites cut "more than two years" ago. Only one site was listed as being harvested over "multiple years" and two sites were listed as "unknown."

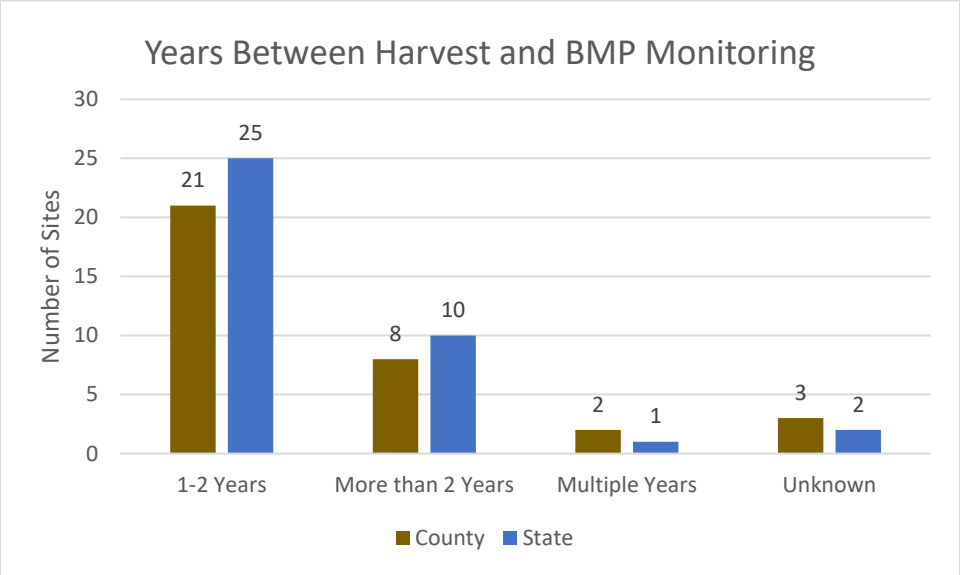


Figure 2. The time (in years) between the time of the harvest and when the monitoring team was on site.

Harvest Size

The harvest size for any sale includes the entire area within the boundary of the sale. This usually includes areas of non-harvest such as: roads, reserve areas, wetlands and streams (unless they are large enough to be "mapped out" of the harvest area). Sales are individual units of harvest that can occur in an isolated location or can border several other active or recently completed sales. A larger area of harvest can be broken down into sales based on a multitude of factors including tree species composition, silvicultural prescriptions, property boundaries, natural boundaries, seasonal restrictions/ time of harvest, tree age, logging contractors, and product demand.

County

There was a total of 2604 acres monitored over the 34 sales which calculates the average acreage to be 76.6 (Table 1). There was a large acreage range within those 34 sales, however, with the smallest sale only being listed at 12 acres and the largest being 183 acres. County sales were evenly distributed

between size groups: 12 *under 51 acres*, 13 *between 51-100* and *over 101* (Figure 3). This is different than the BMP monitoring conducted on county lands in 2013 which saw the county favor much larger sales and have very few small ones. One reason for this possible change was the large salvage sales that took place after a large blowdown event in Northwest Wisconsin in 2011, which were monitored in 2013. It's plausible that the range of acres found in 2018's monitoring to be a more accurate representation of harvests that take place on county forests.

State

There was a total of 3577 acres monitored over the 38 sales which equates to the average acreage of 94.1 (Table 1). The largest sale was 271 acres and the smallest sale was only 15 acres. The range of acres is not as uniform as the county sales with more located on either end of the spectrum (14 sales *under 51 acres*, 18 *over 101*) and very few in the middle (only six sales *51-100 acres*). This may have been caused by the large amount of sales harvested on northern state forests and then those harvested on other properties (fisheries or wildlife properties) in the southern portion of the state. Northern state forests tend to have large harvest areas compared to the small harvests conducted on southern state lands. Comparing to the last time state sites were monitored (in 2013 before this law) the average sale size for BMP monitoring was only 59.1 average acres, which is much smaller than the 94.1 acres observed during 2018 BMP monitoring. Also, there were many more small sales harvested in 2013 when compared to 2018, 23 *under 51 acres* vs. 14 in 2018 and only seven *over 101* acres compared to 18 in 2018.

Table 1. Sale Size Information

Size by Acres	County	State
Acres Monitored	2604	3577
Average Acres per Sale	76.6	94.1
Smallest Sale	12	15
Largest Sale	183	271

Table 1. Different information on sale sizes are shown in acres.

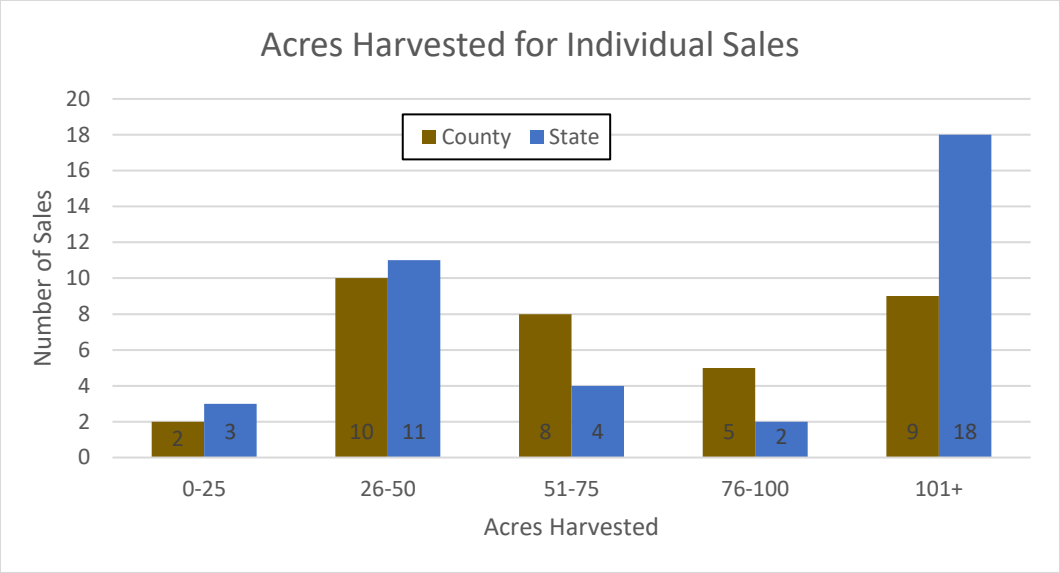


Figure 3. The number of sales that are in different acre size classes.

Season of Harvest

The season of harvest can play a vital role in the success of protecting water quality in silvicultural activities. The presence of water resources within a timber sale may lead to harvesting guidelines where it becomes best to operate harvesting equipment during dry (usually late summer/early fall) or frozen ground conditions (winter). Many recommendations within the BMP manual call for operations during these favorable ground conditions to avoid the potential problems of rutting and compacting hydric soils. Season of harvest was determined by the monitoring team asking the forest sale administrator for the seasons of activity – what season the actual harvest took place. If the sale was reported to have been cut in more than one season, each season was noted (this leads to the "duplication" of sale seasons, so one sale might be represented in Figure 4 in more than one column). Even a sale cut over multiple years could be listed under one or "exclusive" season if it was cut during the same season for a few years. This is common with sales, especially winter sales, where it will take multiple years to finish a sale that is seasonally restricted to frozen ground. Anytime forest sale administrators were not available to be asked, the sale was listed as unknown.

County

The county had 10 sales harvested during solely "winter" months, one sale harvested during solely during "spring" months, three sales harvested during solely "summer" months, and two sales harvested during solely "fall" months. Seven sales were listed as unknown for their season of harvest. This shows the likelihood of a sale being completed in one season is 59.3% or 16 sales out of 27 sales (34 total sales minus the sales with "unknown" seasons of harvest). Of this almost 60% of sales, the majority of those (62.5%) were harvested during the exclusive season of "winter." When looking at sales that had multiple seasons of harvest: eight were harvested in part "winter," zero were harvested in part "spring," six were harvested in part "summer," and seven were harvested in part "fall." "Winter" was still the most common for sales spanning over multiple seasons, but not by much.

State

The state also had 10 sales harvested during solely "winter" months, zero sales harvested solely during "spring" months, five sales harvested solely during "summer" months, and two sales harvested solely during "fall" months. Only two sales were listed as "unknown" for their season of harvest. "Winter" again dominated the sales that were only harvested during one season and had more sales exclusively harvested during "winter" than all other seasons combined. The state had many sales that were cut during multiple seasons, which might be due to the fact of their large size (94.1 acres). Fourteen sales were cut partially during "winter," five sales were partially cut during "spring," seven sales were partially cut during "summer," and 16 were partially cut during "fall." It seemed evident to the monitoring teams after talking with the timber sale administrators, that many sales were started in the "fall" on the easier (drier) ground and continued into the "winter" months. The large number of multi-season sales cut in "winter" and "fall" seem align with this observation.

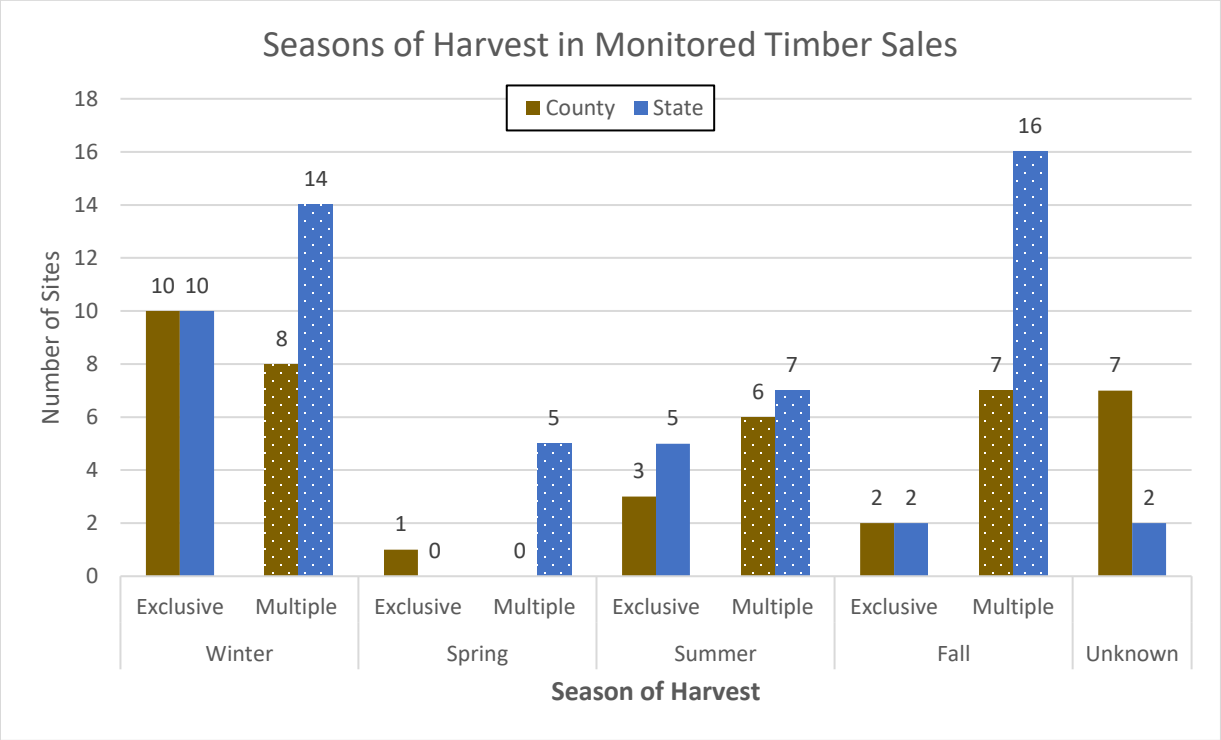


Figure 4. The number of sales shown to be harvest under any given season and if they were exclusively harvested during that season, or part of multiple harvest seasons.

Seasonal Restrictions

A new piece of data was collected compared to the last round of BMP monitoring during 2013-2015 and it is called seasonal restrictions. This is simply calculated by looking at the timber sale map/prospectus to see what seasonal water quality restrictions exist, if any. Seasonal restrictions were broken into three categories: "partially restricted," "entirely restricted" and "no restrictions." "Partial" seasonal restrictions have less than their entire sale restricted, so its range could be vast from 1% all the way to 99% seasonally restricted. Usually this occurred when there was more than one timber type harvested, where one was a predominantly upland harvest and the other was a wetland harvest or working around

wetlands/RMZs. “Entirely restricted” was documented when the sale prospectus/map did not point out a certain area. Language that was included as a restriction were examples like: “frozen or dry,” “firm or frozen,” or “winter only,” or “winter or very dry summer ground.” Language that talked about rutting was not included into seasonal restrictions, such as “no rutting allowed,” along with language that talked about restrictions due to forest health concerns, endangered species, or archeological concerns. The language must have directly tied in with soil and/or water resource vulnerability. The reason rutting language was not considered a seasonal restriction was because all state and county sales have the same rutting guidelines and it does not depend on the season of harvest. So effectively, rutting language is simply put into the sale map/prospectus for an additional reminder.

County

Five of the county sales were “partially restricted” due to water quality concerns. Only nine of the sales were “entirely restricted.” There were more sales that had “no seasonal restrictions” (20) then had some sort of, “full” or “partial,” water quality seasonal restriction (14). This is interesting considering that 18 of the sales, with seven “unknown,” were harvested exclusively or partially in the “winter” season. This means more sales are harvested during the winter months than the restrictions for water quality would demand, which might suggest other restrictions are coming into effect.

State

Five of the state sales were “partially restricted” due to water quality concerns. A little over one-third (14 out of 38) of the sites were “entirely restricted.” Exactly half of the sites had “no seasonal restrictions.” This means that some there were five more sales that were “elected” to be harvested during “winter” (10 solo and 14 partial) than what water quality seasonal restrictions would require (19). This is unexpected because prices for winter wood are often less than their summer counterparts, even within the same sale. Based on this price difference, one would expect only sales that are contractually obligated to be harvested during the “winter” months to receive winter harvesting. Even contractual seasonal restrictions often offer options like “dry summer.” This could even further reduce the amount of “winter” harvests, but in both landowners’ case, does not occur. It is likely that other variables, not considered during this study, are coming into play which would cause the increase of “winter” harvests because it is often not financially beneficial for loggers to cut unrestricted sales during the “winter” season.

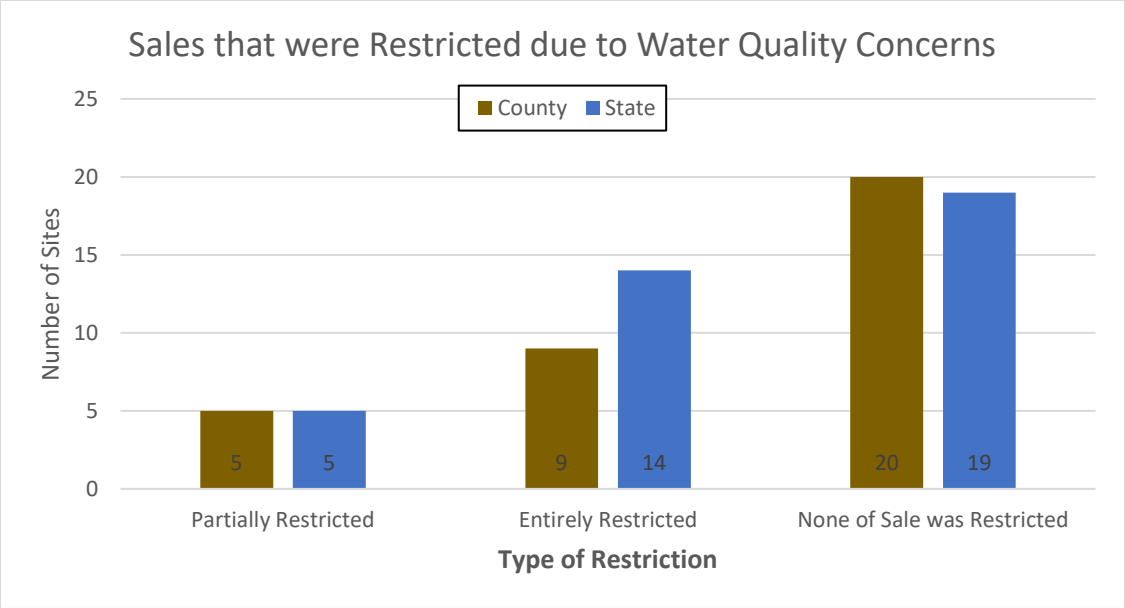


Figure 5. The number of sites that had seasonal restrictions imposed on them due to water quality concerns.

Water Resources

There were five types of water resources (lakes, streams, wetlands, dry washes, springs/seeps) found in the 2018 BMP monitoring sites.

> "Lakes" are designated by their characteristics, specifically, they need to have and Ordinary High Water Mark (OHWM) which is the line that forms the boundary between a terrestrial environment and an aquatic one. OHWMs are formed by the erosive forces that occur over a time period from moving water – either by current or wave action. OHWMs are not truly static nor dynamic and lakes can have OHWMs far above their current water level in times of drought or be submerged during periods of high rainfall – both on a seasonal and multi-yearly cycle. There is no specific size requirement for lakes. The helpful resource for both BMP monitoring teams and foresters alike to identify a lake is the DNR Surface Water Data Viewer (SWDV).
>
> "Streams" also have an OHWM and for monitoring purposes, are broken down even further by their width and designated trout stream classification (Figure 6). Width and the presence of trout are important because these two factors help determine the width distance of the Riparian Management Zone (RMZ) on streams.
>
> "Wetlands" need to meet the three specifications which form their definition: hydrology, vegetation, and soils – but for BMP monitoring purposes wetlands are those indicated by the web resource of DNR SWDV and verified by the monitoring teams when on site. Usually, monitoring teams use a change in vegetation to confirm they are in a wetland environment.

"Dry washes" are channelized areas of overland flow that are not continuous enough to produce OHWMs. Some are also characterized by their highly erodible soils that often lead to head-cutting, v-shaped banks as opposed to a streams general u-shape and found in areas of steep topography. In Wisconsin, dry washes are found abundantly in the Western Coulee and Ridges ecological landscape or commonly called the Driftless Area. This is in mid-western Wisconsin, mostly south and west of Interstate-94 and north of the Wisconsin River. Dry washes are not always identified on computer resources or timber sale maps but are noted by BMP monitoring teams when they are found.

"Springs and Seeps" are the discharge or upwelling of water at specific point on a landscape. Springs and seeps vary greatly in size from nothing noticeable above ground to a three-foot wide stream straight from the ground. Unless they are found within a wetland environment or mapped stream system, they are very rarely identified on computer resources or timber sale maps. They can however, prove irksome during timber harvests because areas that seem to be dry or should freeze, will continually thwart road building and freeze down activities for loggers. BMP monitoring teams noted springs and seeps when they encountered them during their site visits.

County

The most common water resource on county monitoring sites were "wetlands," where 100% of the sites had "wetlands" either crossed, harvested, or adjacent to them. This is in stark contrast with "dry washes" where none were observed. This is to be expected, however because where dry washes are common does not intersect with county owned land. "Streams" were the second most common water resource behind "wetlands" with 23 sites containing, crossing or bordering them. Nine sites contained "springs and seeps" while only six sites had "lakes" bordering them. Overall this is a very similar amount of water resources found on county sites during BMP monitoring in 2013.

State

The state BMP monitoring sites had very similar breakdown to those on county lands and BMP monitoring conducted in 2013. The most common water resource was "wetlands" with all but two sites having them listed as a water resource. "Streams" were the second most common water resource with 23 sites containing or bordering streams. Many of those streams (18 of 23) were either over three feet wide or classified as a designated trout stream. Eleven sites were bordering "lakes." To round off the water resources, six sites had "springs or seeps" and only four had "dry washes."

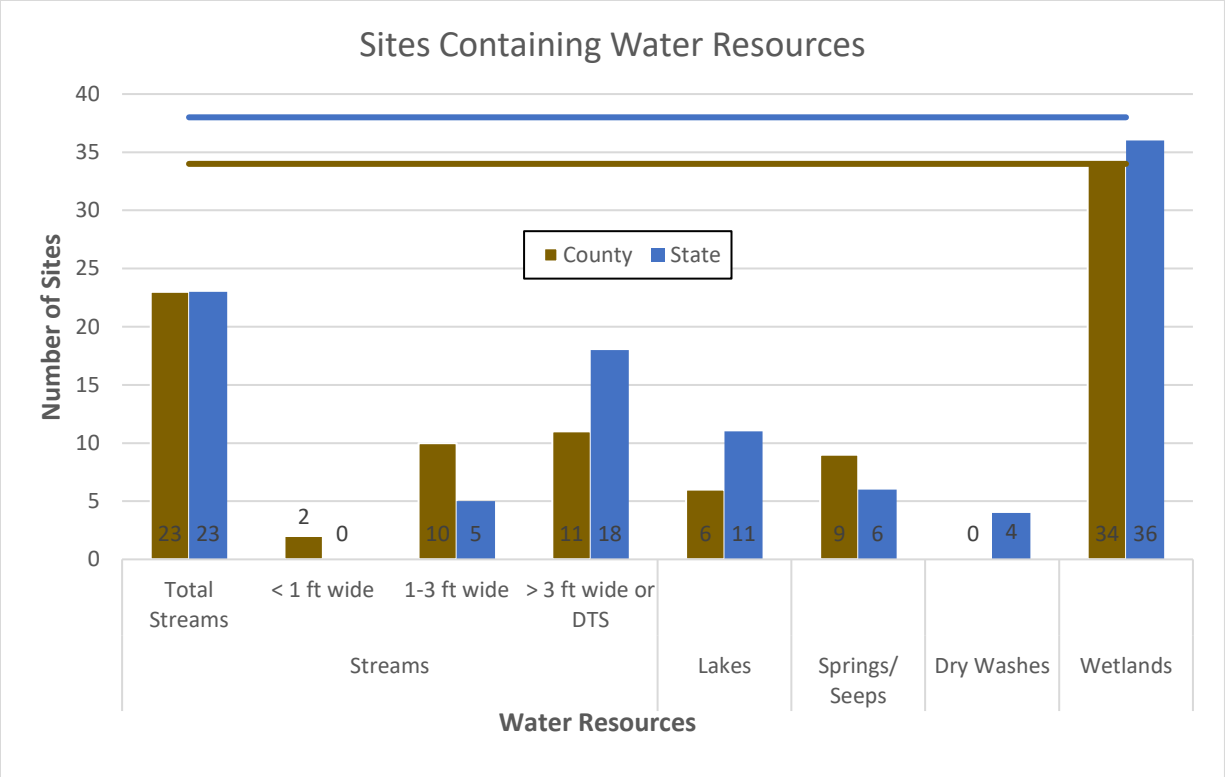


Figure 6. The number of sites that have water features in or around them. "Streams" are broken down into three categories, which correlate to the different RMZ standards. The horizontal line at the top of the graph represents the total number of sites monitored and is therefore, the maximum potential for any one water resource.

Stream Crossings

Stream Crossings can occur in one of two infrastructure categories during a timber harvest: either forest roads or skid trails. The primary difference between the two is the expected traffic that the crossing must endure. Stream crossings on forest roads must hold up to weighted logging trucks, which concentrates their weight more than other off-road logging equipment. Stream crossings on skid trails must only hold up to forwarders, harvesters, or skidders, which usually weigh less than logging trucks. BMP monitoring teams documented types of structures used to cross streams and contacted the forest administrator if the structure was removed or temporary (Table 2). It is important to note that sites with multiple crossings of different structures within the same infrastructure type will be listed multiple times as will sites that have crossings on both forest roads and skid trails.

County

The county had seven sites with stream crossings on their forest road system. All but one was crossed using culverts as their structure. There was much more diversity of structure types used on the skid trail system. There were five crossings listed for sites on the skid trail system with only one of those being a duplicated structure. Two crossings used slash mats also called a pole ford, which is nothing more than logs or branches, usually unmerchantable, placed into the stream to distribute the weight of equipment

and stop rutting within the stream bed and bank. One crossing was used of each of the following structure types: culverts, frozen stream/ice, and unknown. Since most of the crossings on skid trails are temporary, the forest sale administrator was often asked which type of crossing was used if it was not evident to the monitoring teams.

Figure 7. Stream crossing on the forest road system with a culvert. Rock has been placed around the culvert to minimize bank erosion into the stream.

State

The state had five crossings on their forest road system but had more variation with culverts being the only structure used twice. The three other structure types were timber mats, bridges, and other. There were more crossings on the skid trail system for a total of eight. The most abundant structure type on skid trails were frozen stream/ice crossings. Both slash/pole fords and timber mats had two crossing each and one was crossed with no structure. Crossing with no structure indicates either very few crossings taken by the equipment and/or on a stream that has a high makeup of rock in its bed and bank. This is not an option for crossing most streams in Wisconsin for logging purposes, but in the right stream and geomorphology, it can still be successful and uphold BMP principles.

Figure 8. Location that was used for a temporary stream crossing on the skid trail system. No material was left in the stream and the season of use provided the loggers with excellent bank stability.

Table 2. Stream Crossings on Timber Sales			
Crossing Location	Crossing Type	County	State
Forest Road System	Culverts	6	2
	Timber Mats	0	1
	Bridges	0	1
	Other	1	1
Skid Trail System	Culverts	1	0
	Frozen Stream/Ice	1	3
	Slash/Pole Ford	2	2
	Timber Mats	0	2
	No Structure	0	1
	Unknown	1	0

Table 2. Shows the number of stream crossings that occurred on timber sales along with what structures were used and if they were crossed on forest roads or skid trails.

Riparian Management Zones

Riparian Management Zones (RMZs) are areas where forest management are modified next to a stream or lake in order to provide shade, soil stabilization, and other functions. Excess heat or erosion caused by exposed soil in an RMZ can possibly lead to impacts to water quality. The two RMZ widths are 100 feet and 35 feet. A 100-foot wide RMZ is recommended for lakes, streams of a width three feet or greater, and all designated trout streams. A 35-foot wide RMZ is recommended for the two categories of streams less than three feet wide. The RMZs have different BMPs unique to each resource. RMZs width and the applicable BMPs can be modified, per the BMP manual, by foresters – base on professional judgment due to site-specific considerations, management objectives and other reasons. The monitoring team will not the recommended RMZ width from OHWM to the timber harvesting edge can fall into one of five categories:

- The RMZ can be “increased” in width
- The RMZ can “meet” the recommended width
- The RMZ can be “decreased” in width
- The site may “not have used” an RMZ
- The site may have “multiple” categories (increased, decreased, meets, or not used) of RMZ.

Most sites will fall into one category or the other, but sites can have “multiple” RMZ categories and is usually a result of a larger sale that involves more than one timber type bordering a stream or the topography of the sale varies greatly from one end of the sale to the other. An RMZ “not being used” in a timber sale is usually on monotypic or mostly monotypic stands that vary in their closeness to a stream but never border the stream. An example of this is a red pine thinning that transitions to alder/birch stream border. The alder/birch border will vary in its width to the stream causing the RMZ from the red pine to the stream to fluctuate but, an RMZ (of set distance) was not used because the birch/alder acted in the same ecological function as a “painted out” RMZ would.

Sites that have more than one class of stream or a lake and a stream less than three feet wide will be listed twice. This means that adding up the number of sites listed under the RMZ section will not equate to the number of sites that contain the water resources of “lakes” and “streams.”

Figure 9. RMZ Stream corridor shows tree species (hemlock) that fulfills the requirement to "promote long-lived tree species appropriate to the site."

County

Thirteen sites had an RMZ "increased" on county land, which is the same number of sites that had RMZs that "met" the recommended width set by the BMP manual. Only five sites had RMZs that "decreased" the RMZ width. Three sites had RMZs of "variable" widths and one site did "not use" an RMZ. This is consistent with the data from 2013 with the two most common categories being "increased" and "meets" as well. There is no definitive pattern for RMZ distance categories to be influenced by the water resource – meaning "lakes" don't always seem to have an "increased" RMZ or "streams" <1 foot wide seem more likely to be "decreased." This could be considered a positive item because it means that timber sale administrators are considering site conditions carefully rather than routinely establishing cookie-cutter type methods based on a resource which might not provide as much function as an RMZ modified to site conditions.

State

The data collected for state sites mirrored the county data and had the most two categories for RMZs be "increased" (13) and "meets" (18). Four sites had their RMZ "decreased." Only on one site was an RMZ "not used" and again with one site having a "variable" RMZ utilized. This data matches that from the 2013 BMP data and like the county's findings above – RMZ distance categories do not seem to be influenced by the water resource.

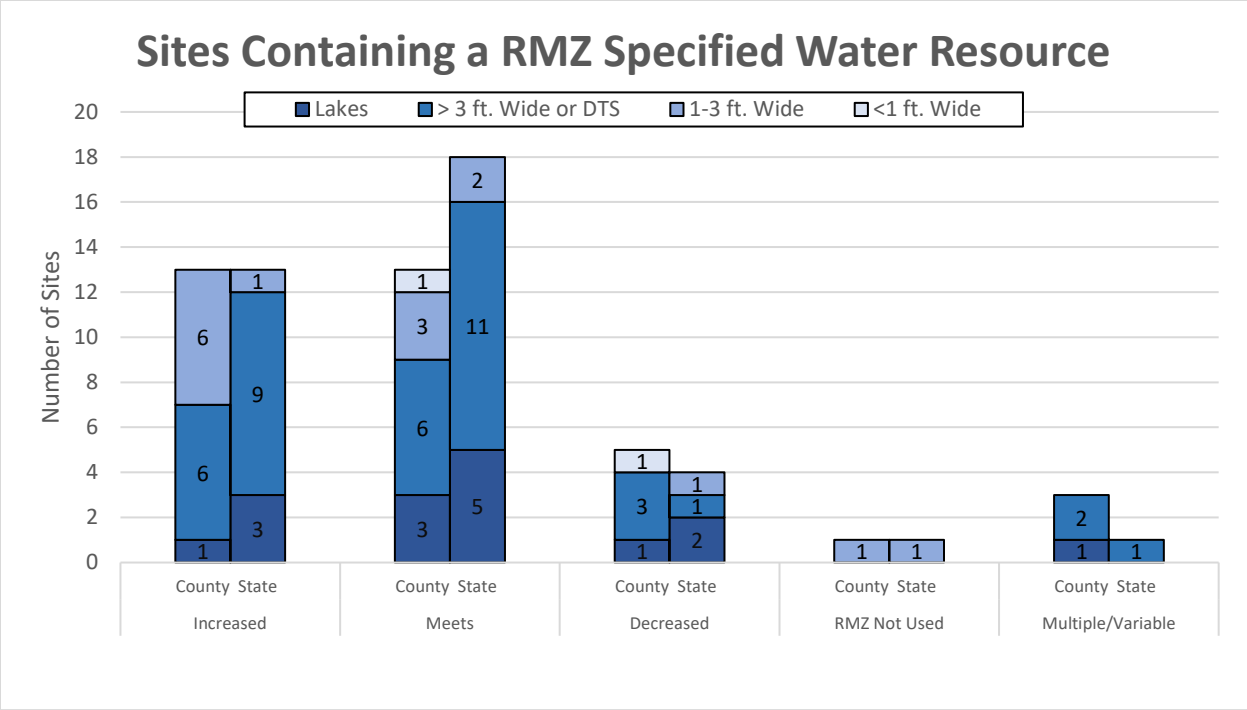


Figure 10. The number of sites that fit into different categories of RMZ recommendation distances.

Species Composition of Harvest Sites

Seven different timber type compositions were listed in the 2018 monitoring report. Anytime they were present to a significant degree, they were recorded as being a dominant cover type for the harvest. This leads to many sites having more than one dominant cover type.

County

The most common type of dominant timber type for county lands was “aspen,” where 19 sites listed them as a major component. In the middle of the pack was four different timber types of “maple/basswood” (12), “spruce/fir” (10), “oak/hickory” (9), and “pine” (8). To round out the bottom of timber types there was “other” (6), “swamp conifers” (4) and “bottomland hardwood” with only two sites listing them as dominant. This is very similar with 2013 BMP data where “aspen” was listed as top and “maple/basswood” and “oak/hickory” tied for second.

State

“Aspen” was also the most dominant timber type just as it was for the county at 22 sites. However, “pine” was a close second at 19 sites and “oak/hickory” was the third most common at 16 sites. “Maple/basswood” was in the middle of the pack with nine sites listing it as dominant. Rounding out the least dominant timber types were “other” (5), “spruce/fire” (3), “bottomland hardwood” (2) and “swamp conifers” (1). This reflects the BMP monitoring of 2013 where “pine” and “aspen” were listed as the most common dominant timber types with 20 sites each.

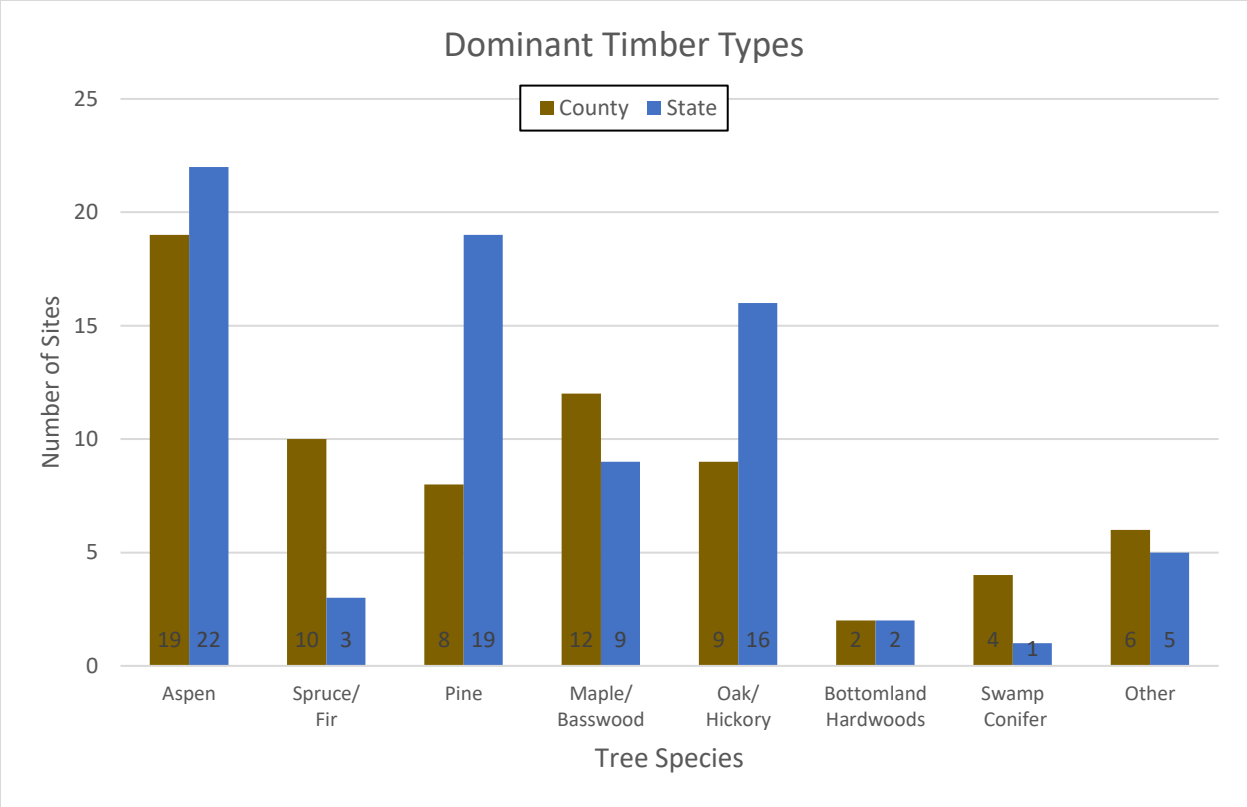


Figure 11. The number of sites that had different timber types listed as being dominant. Sites could be listed as having more than one dominant timber type.

Silviculture Prescriptions

Silviculture prescriptions determine several aspects of a timber harvest: it can determine which trees get harvested, how many trees get harvested, what the remaining tree density should be, and may determine which tree species are established post-harvest. Sites can have more than one type of silviculture prescription – this is common when there is more than one type of dominant timber type.

County

The two most common types of silvicultural prescriptions for county lands were “clearcut with reserves” at 17 sites and “selection harvest” at 15 sites. Regular “clearcut” had eight sites and five sites listed “other” as their silvicultural prescription. The least common utilized silvicultural prescriptions were “shelterwood” (2) and “seedtree” (1).

State

The state had selection harvest listed as the most common type of silvicultural prescription utilized. Both “clearcut” and “clearcut with reserves” were tied for second most common at 13 sites. “Other” was listed for nine sites and “shelterwood” was listed at six sites. There were no “seedtree” silvicultural prescriptions observed during BMP monitoring.

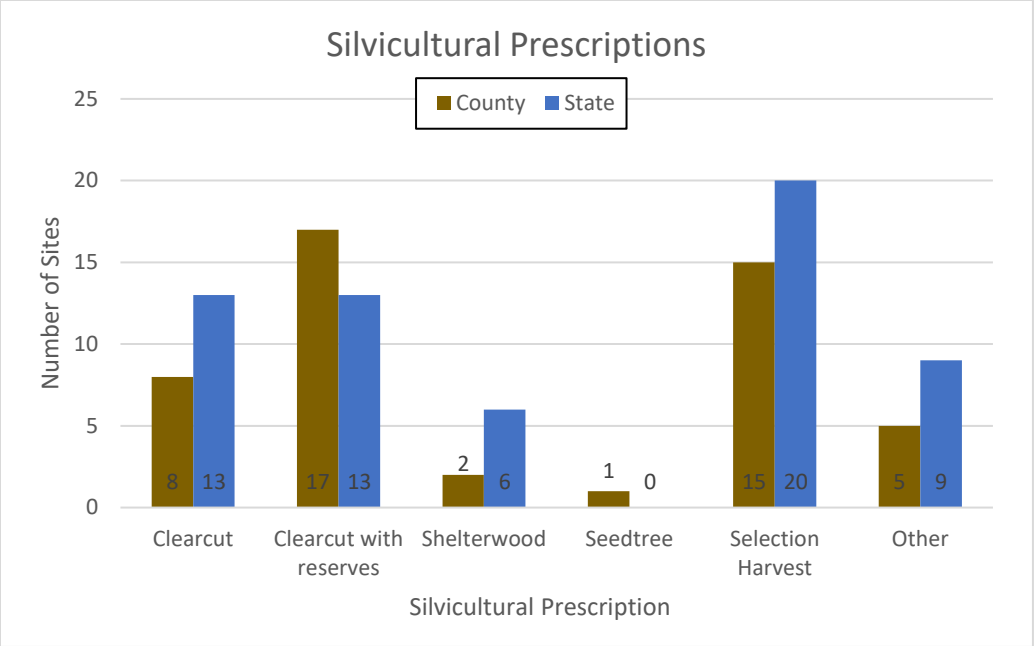


Figure 12. The number of sites with different silvicultural prescriptions. Sites can have more than one type of silvicultural prescriptions.

Timber Stand Improvements

Timber stand improvements (TSI) are defined as improving the quality of a forest or tree stand by removing undesirable trees or tree species to obtain the desired forest composition or forest timber productivity. This may include methods that yield no current merchantable timber, including girdling, spraying herbicide, and burning. Often, TSI's are used due to the prevalence of invasive species within a timber stand. Treating invasive species before a timber harvest might provide a better opportunity to regenerate target tree species back into the timber stand.

County and State

Very few sites from either the county or the state had TSI work observed by the monitoring teams (Table 3). Five sites for the county observed "crop tree release," while the 29 remaining sites had "no" TSI listed. The state had a few more with four sites listing "crop tree release" and five sites listing "other" for TSI work. Just like the county, 29 state sites observed "no" TSI methods used.

Table 3. Timber Stand Improvements

Timber Stand Improvements	County	State
Pre-Commercial thinning	0	0
Crop tree release	5	4
Other	0	5
None	29	29

Table 3. The number of sites that have different timber stand improvements.

Harvest System

Harvesting systems are the processes loggers choose to get merchantable material (trees) to the market that is in turn dictated by the markets they are selling their product to and the equipment they have. Shortwood in harvesting system refers to trees that are leaving the forest land in smaller lengths, usually 8 feet, but can be longer for lumber purposes. This can be done with numerous equipment types and is by far the most common system used. Tree-length is where the wood is going to be used for markets that use long pieces of timber, such as telephone poles. Whole tree is a system where the entire tree gets utilized, normally via chipping. Trees are normally skidded or grappled to a central landing that contains a large chipper. The tree is then chipped into tractor trailers then hauled off-site. Harvesting systems that include other usually involve a niche product that are worth money.

County

Shortwood was the most common type of harvesting system used on county land with all but two sites using that as their harvesting system. Tree-length and whole tree each had one site each and no sites had other listed for a harvesting system.

State

Shortwood was also the most common type of harvesting system used on state lands. Just like with county land, state land had all but two sites use it as their harvesting system. Tree-length and whole tree were not utilized on state land. Two sites did list other as their harvesting system.

Table 4. Harvesting System

Harvesting System	County	State
Shortwood	32	36
Tree-length	1	0
whole tree	1	0
other	0	2

Table 4. The number of sites that have different harvesting systems utilized by the loggers.

Equipment

The BMP monitoring teams determined the equipment used for the harvest operation using several methods. If the forester administering the sale was present, they simply asked him/her for that information. Otherwise, looking for signs of either wheel or track marks on the ground helped determine the type of equipment. If the ground was dry, frozen, or had lots of snow, the equipment marks would be difficult to see if present. This can be complicated by the fact that most wheeled equipment can put “tracts” over sets of tires to achieve less ground pressure. For this study, tracked equipment was only that of plated metal tracks – not tracked up wheeled equipment.

County

The county had more than 55% of its site (19) contain both wheeled and tracked equipment. The second most category was unknown with 9 sites. Only wheeled equipment was used on five sites and only one site had all tracked equipment. This is very similar to data collected during BMP monitoring in 2013 where 22 sites had both wheeled and tracked equipment and only 1 had exclusively tracked equipment.

State

The state saw similar levels of equipment type usage with both being the most common with 23 sites. Only six sites used tracked equipment and seven sites used exclusively wheeled equipment. Two sites were listed as having unknown equipment types. This does differ a little from 2013 BMP monitoring which had 17 sites listed as having wheeled equipment and only one site having tracked. However, there was the same number of both listed with 23 sites.

Table 5. Equipment Type

Logging Equipment	County	State
Tracked	1	6
Wheeled	5	7
Both	19	23
Unknown	9	2

Table 5. The number of sites that utilized different equipment types.

Road Systems

Forest roads serve several purposes: access to the sale by trucks and other equipment, moving wood from the sale to the landing, and in some cases provide area for decking. How roads are designed, constructed, and maintained plays a large role in how successful a harvesting operation will be at protecting water quality. Roads that go through, or adjacent to wetland, or roads that go against the contours will most likely require some type of drainage structure to ensure that the road stays in usable condition and that water quality is not negatively impacted. For forest roads that go through wetlands, equalization culverts help to maintain hydrologic flows beneath the roads, which will stop water buildup that may potentially wash out the road. For roads that go up and down contours: water bars, broad-based dips, out-sloping, or ditches can help reduce the flow on the road surface – which will extend the life of the road. The amount of drainage structures on roads that go across the contours will greatly depend on several features, but primarily the length and gradient of the road.

In addition to building roads to handle the expected traffic for timber production needs, forest roads are increasingly being used by other forms of traffic as well. This is especially true for publicly owned land such as county and state because other user groups like to use forest roads for access to enjoy their hobbies (such as hunters) or use forest roads as the foundation of their hobby (such as ATV users). This puts extra burdens on forest roads because they sometimes need to be built to a higher standard than the timber product would demand. If the road is not receiving extra funding from such extra user groups or through the landowner, the financial burden for maintaining and building of these forest roads might

be put on the logger to a higher degree than what is needed for them to harvest the timber. Two ways public land owners mitigate this burden on the logger are contracting out road work to other private contractors or by offering sales that use the road to be sold at lower costs. Then, that increased profit can be used on road building for the landowner. Regardless of how it happens in the background, the application of forest road BMPs become even more important to build and maintain a road that does not harm water quality.

It is important to note that all types of road design and constructions can be successful at preserving water quality. This greatly depends on several factors: road traffic, seasonal closures, soil characteristics, topography and grade, roadbed additions and drainage control structures. If all the variables are considered correctly, water quality will not be negatively impacted by building and maintaining forest roads.

Road Presence

County

Thirty-one of the 34 sites had forest roads present within, used, or adjacent to the timber sale. All thirty-one had some type of forest road system before the timber sale started but 18 sites also were listed as having their forest roads improved or built for the timber sale. Activity was common on forest roads and 25 sites had sales with active forest roads and 12 sites had inactive forest roads. There was some overlap between sites that had active and inactive forest roads. There were six sites with new drainage structures found on forest roads and 11 sites with existing drainage structures found on forest roads. There were 20 sites that had log landing observed by the monitoring teams and 26 sites that had some form of wetland infrastructure such as wetland roads or landings.

State

Thirty-four of the 38 sites had forest roads monitored. All but two of those sites had some form of existing road prior to the timber sale. Nineteen of those sites received some level of improvement or the addition of forest road segments. Over 2/3 of the sites (24/34) contained active forest roads. Twenty sites contained inactive roads. Only one site had new drainage structures on forest roads, whereas seven sites had existing drainage structures.

Most of the sites, 32, did have log landings located on the timber sales. A little over half, 21 out of 38 contained wetland infrastructure such as wetland roads or landings.

Table 6. Road Characteristics

Road Characteristics		County	State
Sites with Roads Present		31	34
Road Building	Existing	31	32
	Improved	18	19
Road Use	Active	25	24
	Inactive	12	20
Roads with Drainage Structures	New	6	1
	Existing	11	7

Table 6. The number of sites that utilized forest roads and the different road characteristics found on monitoring sites.

Water Control Structures on Forest Roads

County

The county had several water control structures found on its forest road system. The vast majority of those were "culverts," both existing (11 sites) and new (6 sites). From there, the next most common structure was "diversion ditches," where three sites listed existing structures present and three new structures present (Figure 13). One site had new "water bar(s)" listed and another site had existing "broad based dip(s)" utilized. Other types of water control structures such as "open-top culverts" were not observed.

State

The state sites had fewer water control structures on forest roads than county lands. The most abundant type of structure used was "cross drain culverts" with all but one of the eight observed were existing. There were three "diversion ditches" used, two new and one existing. No other water control structures were observed on state lands.

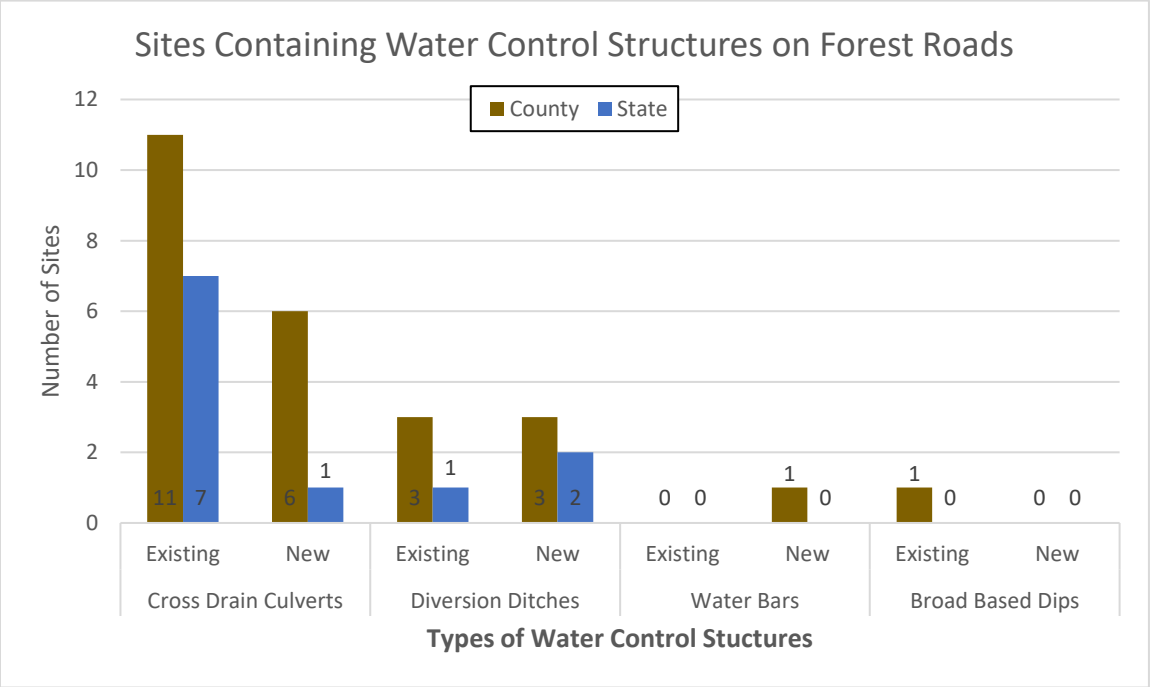


Figure 13. The number of sites that used different types of water control structures on their forest road systems.

Road Design and Construction

County

Most road designs on the county forest system are "flat," with 23 sites listing that as primary road design. Eight sites did have "multiple road designs" which is to be expected because large landowners often have multiple different types of roads leading to a singular timber sale. There will often be a permanent all-season road leading to many blocks of timber stands, followed by permanent seasonal roads which access a few sales. Lastly, a temporary seasonal road will often be used to access a singular sale. These types of roads are often those listed as "flat" and may eventually grow over with vegetation and/or dead-end within the sale boundary. There were no sales that exclusively used "crowned," in-sloped, or out-sloped roads.

Road Construction on county land was diverse with 13 sites listing "multiple" construction types featured. The most common type however, was "at grade" with 16 sites. Only two sites had "ditching," one "shallower than one foot" in depth, the other "greater than one foot" in depth. No sites were listed as "below grade" or "fill with no excavation."

State

Forest road design on state land was most commonly "flat," which was the primary design for 28 sites out of the 34 which contained forest roads. Only four sites had "multiple road designs" listed and two sites were listed as having a "crowned" road design. No sites were exclusively "in-sloped" or "out-sloped."

Road construction follows a similar story to road design, because almost all the sites fall into one category, in this case, 25 sites are listed as "at grade." Six sites are listed as having "multiple road constructs" offers a little variability. One site is listed for each of the following three road construction types: "below grade," "ditching less than one foot deep," and "ditching greater than one foot deep." There were no sites with "fill with no excavation" listed as a construction type.

Table 7. Road Design and Construction

Road Designs and Construction Features		County	State
Road Design	Flat	23	28
	Crowned	0	2
	In-Sloped	0	0
	Out-Sloped	0	0
	Multiple Road Designs	8	4
Road Construction	Below Grade	0	1
	At Grade	16	25
	Ditch > 1ft	1	1
	Ditch < 1ft	1	1
	Fill with No Excavation	0	0
	Multiple Road Constructs	13	6

Table 7. The different types of road design and construction used by monitoring sites.

Figure 14. Picture of a forest road used during a frozen ground harvest – also illustrates the amount of water this area received during the summer/fall of 2018.

Severe Weather

One of the biggest wild cards when it comes to preserving water quality during a timber harvest is the amount of precipitation that falls during a timber harvest. Plans can be made for sites with numerous water features such as streams and wetlands and will receive bids accordingly, but precipitation is always an unknown. Small amounts can make sales that are normally difficult to harvest, much more manageable. Unfortunately, the opposite is also true; timber sales that appear to be easy and straightforward, can become an operational or logistical nightmare when large amounts of precipitation falls. This can be true whether the precipitation falls on a higher yearly or seasonal average or over a short period like a storm even. One element during 2018 BMP monitoring that was different than many of the BMP monitoring years is the precipitation that occurred throughout Wisconsin – both in severity (specific events) and comparison to yearly averages.

County

Many of the county harvests monitoring during 2018 were pounded by wet weather. Eighteen of the 34 sites monitored were listed by the BMP monitoring teams as having severe weather. This may have

occurred during the actual harvesting or after the harvest was finished but before monitoring events had taken place. Most of the county sales listed as having extreme weather were citing specific storms (the 2016 storm that took out road infrastructure in northwest Wisconsin, including the 2018 "Father's Day Storm" that again affected Northern Wisconsin). Comparing 2018 to 2013 BMP monitoring, there were only six sales listed with extreme weather, this lead to a 300% increase from 2013 to 2018. In general, there was a great concentration of county sites that overlapped areas hit by the two storm events – both were listed as 100-year flood events or greater.

State

Just like county lands, eighteen of the sales were listed as having severe weather. This is 47% of all sales monitored, which is again up from six in 2013 BMP monitoring. One element that was different from the counties extreme weather was state lands sites were simply listed as having above average rain accumulation having occurred within the area. Singular storm events were not usually cited.

Figure 15. Picture of Storm Damage – Eroded hillside leading to a stream. This newly collapsed hillside was a direct result of the extreme storm events that took place in the area during June 2018.

Results

Overview

During the 2018 Wisconsin Forestry Best Management Practices for Water Quality, 75 sites were visited by the monitoring teams and included 38 sites for state lands and 34 sites for county forests. For each of these sites, 119 BMPs were assessed for application and effectiveness (See Appendix E). These BMPs were divided into five categories:

- "Fuels, Lubricants, Waste and Spills": There are two BMPs on the monitoring form and they relate to location of fueling and cleaning up waste and spills.
- "Riparian Management Zones (RMZs)": There are 18 BMPs on the monitoring form and are divided into sections according to different RMZ that occur on subsequent water bodies.
- "Forest Roads": There are 47 BMPs on the monitoring form and they are divided into several sections which cover a variety of aspects, including location, drainage structures, and stream crossing on forest roads.
- "Timber Harvesting": There are 36 BMPs on the monitoring form and they are divided into a multitude of sections which include: skid trails and all aspects regarding them, log landings, and dry washes.
- "Wetlands": There are 15 BMPs on the monitoring form and they cover wetland harvesting, filter strips, and rutting in wetlands.

When teams go through the process of monitoring a site, they decide which BMPs apply to the site and how well the site protected water quality by using (or not using) BMPs – which is termed evaluating for application and effectiveness. There are several different application categories that describe how the landowner either used, or did not use a BMP, as applicable. In turn, BMP effectiveness is rated for individual BMPs and is also divided into the different categories of application.

BMP Application

The first element that a monitoring team must decide when answering a BMP from the monitoring report is to determine if the individual BMP question is applicable to the site. The five options of BMP applicability are:

- BMP *not applicable* to the site
- BMP *applied correctly* where it was needed
- BMP *applied but incorrectly*
- BMP *not applied* where it was needed
- *Insufficient information* to rate how the BMP was applied

BMP Application Rates

The majority of BMPs (64.2% - county, 65.5% - state) are *not applicable* to the monitoring site (Figure 16). Even with the high number of water resources, remember that 100% of county lands had wetlands adjacent to or within the site, most of the BMPs go unanswered because they do not pertain to the site. Just because sites have streams or wetlands, does not mean every BMP question in that category gets answered. Sites containing streams will not always cross streams – which is a large portion of BMP monitoring questions. This translates to most of the 119 BMPs, which range across the spectrum of soil stabilization, culverts, wetlands, stream crossings, and RMZs, get left blank because they do not apply to the site. The remainder (35.8% - county, 34.5% - state) of the BMPs do pertain to the sites and are supposed to be implemented on-site to protect water quality. For the remainder of the report, the focus will be on the BMPs that were applicable to each site.

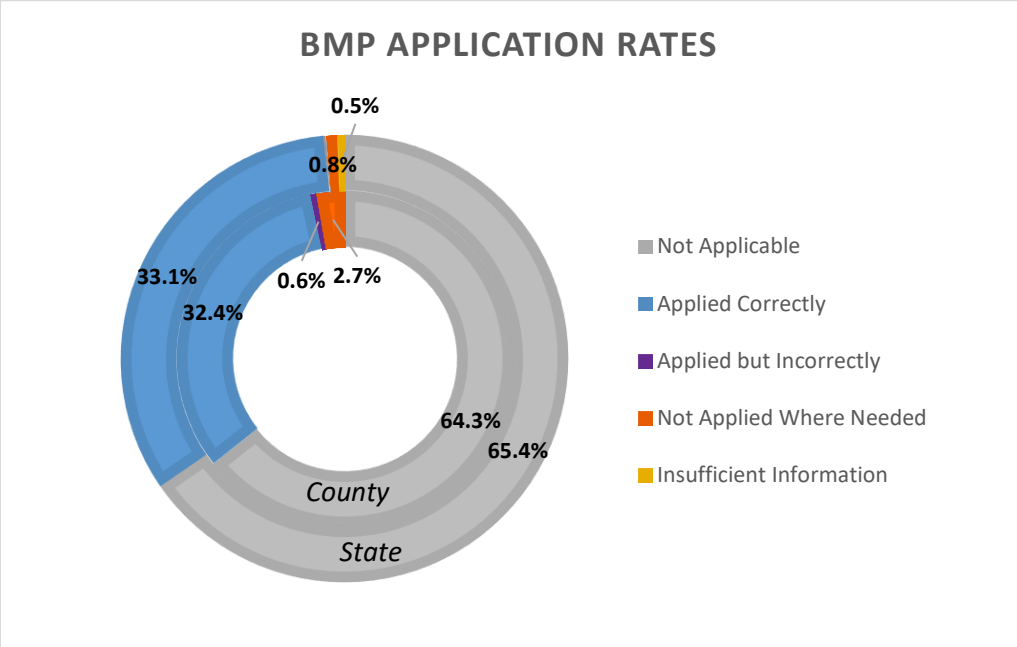


Figure 16. This shows the percentage of BMPs that were applicable for the monitoring teams to evaluate on application and effectiveness.

County

Application rates for county forests were 92.5% for applicable BMPs, both correctly or incorrectly applied. Examining only BMPs that were *correctly applied*, the percentage only dropped to 90.7% (Figure 17). BMPs were *not applied* where needed 7.5% of the time. The *correct application* rate for county lands did drop 2.3% from 2013 to 2018. One plausible explanation for this occurrence is all the extreme weather that plagued the areas where many of the county timber sales are located. Since BMPs are not prescriptive, it means that washed out roads will be scrutinized heavier by monitoring teams. This lends to the perspective that areas affected by storms will be viewed by monitoring teams as not applying a BMP when they should have – because the result of not applying a BMP (such as a water bar or broad base dip) caused the road to fail. Whereas the same conditions without a severe storm may not wash out leading the monitoring teams to come to the visual conclusion that the road was designed

appropriately, and no water control structure was needed to protect water quality. In this light, expectation would be that storm affect monitoring sites will likely receive lower *correct application* rates.

State

Application rates for state lands was high at 97.7% and *correct application* was barely less at 97.2%. Only 2.3% of the time was a BMP applicable to the site and was *not applied*. This means that BMPs were *applied incorrectly* only 0.5% of the time. This is very similar to 2013 monitoring results where BMPs were *correctly applied* 97.1% of the time – a 0.1% difference from 2018.

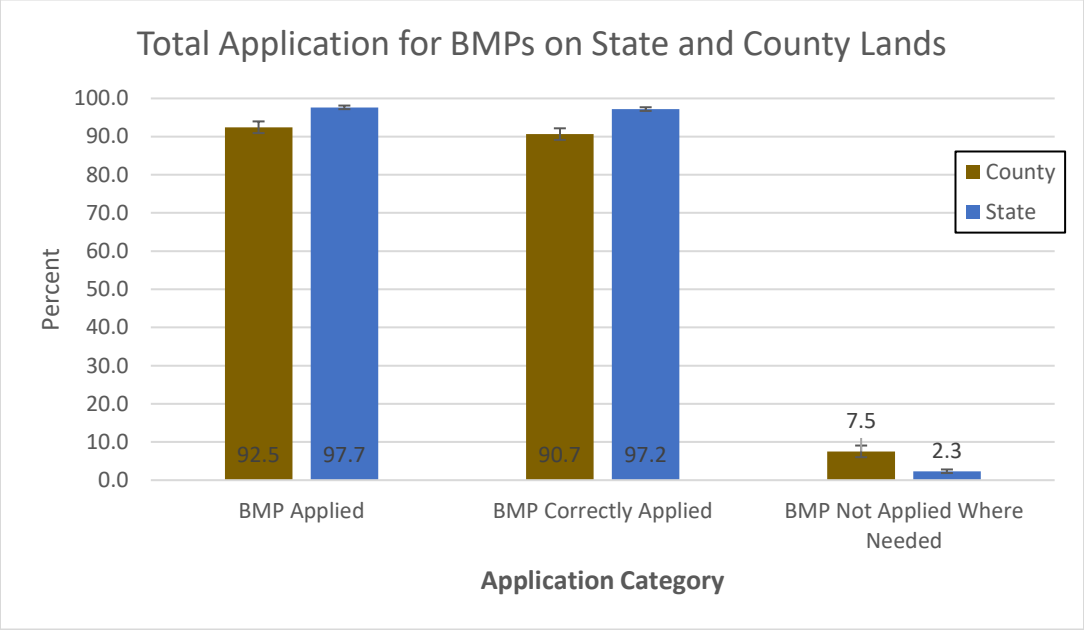


Figure 17. This figure shows the application rates of different application categories, as a percentage on county and state sales, for BMPs that were determined by the monitoring teams to pertain to the site.

BMP Application by Monitoring Category

BMP application rates were broken down into respective monitoring categories to provide greater detail of where BMPs were undergoing high or low compliance. Variances in *correct application* rates, between the monitoring categories, are both common and expected. This is due to the intrinsic properties between the monitoring categories and how easy or difficult it is for landowners to *correctly apply* BMPs. For example, "forest roads" is a BMP monitoring category where it is usually more difficult to achieve a higher BMP *correct application* rating than the monitoring category of "fuel, waste, and spills." Here are just a few reasons the BMPs for "forest roads" are more difficult to achieve compliance:

- "Forest roads" BMPs are subject to criteria like location and design
- "Forest roads" have both short- and long-term maintenance, which may include road closure
- "Forest roads" may receive un-intended or post closure use

This is compared with BMPs for the monitoring category "fuels, waste, and spills." To achieve a high *correct application* rate in this monitoring category, trash or spills must be cleaned up – if they occurred at all.

County

"Fuels, Waste and Spills" along with "RMZs" received a very high *correct application* rate, both at 98.5% (Figure 18). "Timber harvesting" and "wetlands" received *correct application* rates in the nineties (93.3% and 91% respectively). "Forest roads" on the other hand, were almost a full ten percentage points behind the next lowest monitoring category with only 81.9% *correct application*. With "forest roads" being lower than the rest of the monitoring categories by a fair margin, the overall *correct application* discussed earlier was lowered from past years. Comparing 2018 *correct application* in different monitoring categories to 2013"s data; "Fuels, waste, and spills" and "RMZs" were almost identical at 0.1% and 0.2% higher in 2018. This is different from "wetlands," "timber harvesting," and "forest roads," where each of these categories had a decrease in 2018 of 2.2%, 3.5% and 2.5% respectively. All three of these categories receiving a lower *correct application* rate in 2018 contributed to the overall *correct application* rate dropping by 2.7%. All these categories can be heavily influenced by the amount of rain received and severe storm events. Saturated ground is much less forgiving on all parts of the harvest operation, while storm events will test even the best built and designed forest road. The drop in these categories while maintaining a high *correct application* in "RMZs" and "fuels, waste, and spills" would further indicate that severe and wet weather played a factor during the 2018 BMP monitoring on county lands.

State

All monitoring categories for state lands had relatively high *correct application* rates with "fuels, waste, and spills" having the highest at 100% and "forest roads" being the lowest at 93.6%. Comparing 2018 to 2013 data, all the categories went up or stayed the same except for "forest roads," which dropped by 1.3%. This led to the overall *correct application* rating to differ by the marginal amount of 0.1%.

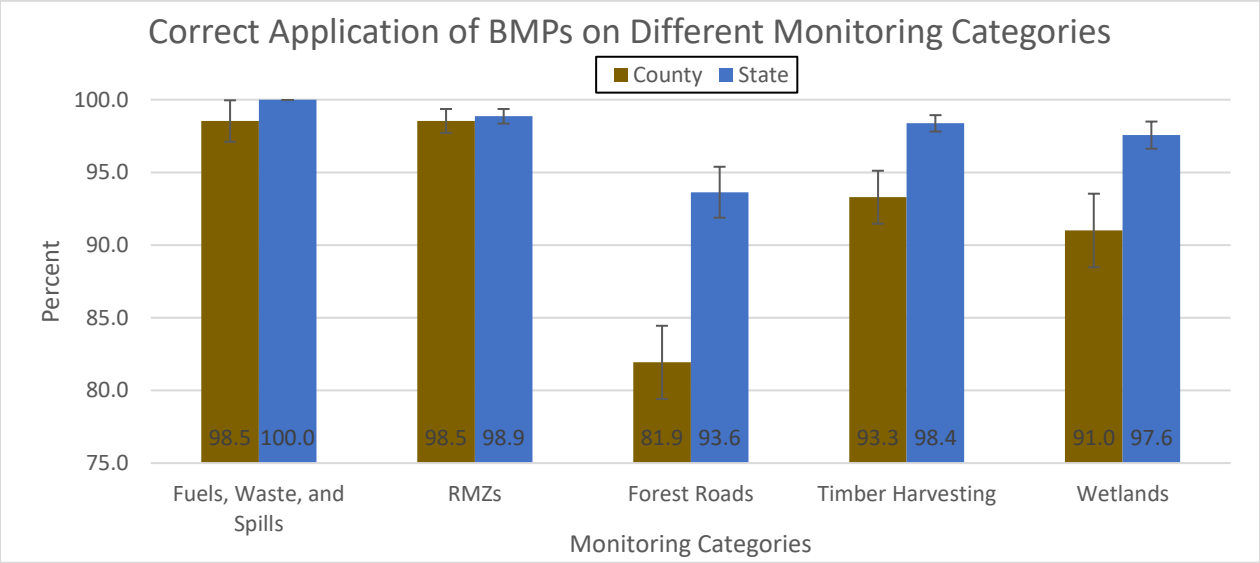


Figure 18. This shows the application rates between the five different monitoring categories.

Figure 19. A collapsed culvert on a forest road, this culvert was not put in for the sale, but was pre-existing. Pre-exiting water quality problems, along with post-harvest issues, causes forest roads to suffer the low rates of correct application when compared to other monitoring categories.

2018 BMP Correct Application Rates Compared to Prior Years

The comparison of current results to past findings is an extremely important function of the BMP monitoring program. It allows the question to become answerable "is Wisconsin's BMP program protecting water quality?" By comparing the application rates from different years – silvicultural activities can be shown to ensure continued, ever improving protection of water quality in Wisconsin. This self-evaluation also allows for changes to the BMP program to be made, so it can adopt the new ways to measure and protect water quality. Changes to both the BMP manual and the monitoring worksheets have occurred, since its start in 1995, to incorporate better ways to monitor and protect water quality.

County

Over the four times county lands have been monitored since the start of Wisconsin's BMP program in 1995, there is an overall improvement trend (Figure 20). Comparing the original '95-'97 data to the most current 2018 data, the county has shown 4.6% improvement. The 2018 does not show an improvement from the more recent monitoring times in 2003 and 2013 – but is down only 2.4%. These overall *correct application* rates will be broken down into monitoring categories later in the report.

State

The state has shown significant improvement in *correct application* rates over the course of BMP monitoring. It is over 10% better from the baseline data in 1995-1997 to the current 2018 data. There has been an increase in *correct application* rates every time state lands have been monitored; although the most recent increase was almost negligible at 0.1%.

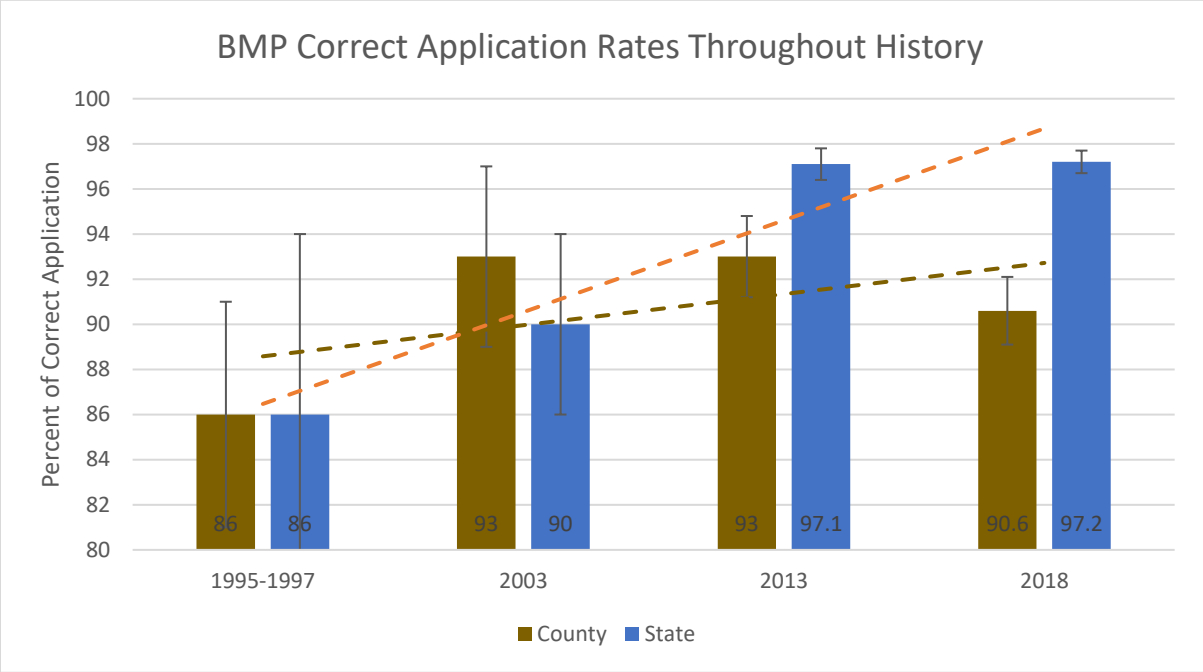


Figure 20. This figure shows the *correct application* rates throughout the state's BMP program history, from its start in 1995 to current day, 2018. Trend lines have been added to show the overall change in application rates, which is positive growth for both county and state lands.

County

Taking a closer look at *correct application* rates over time can be done by breaking it down into monitoring categories (Figure 21). For county data, two categories ("fuels, waste, and spills" and "RMZs") have been improving or retaining high rates of correct application since the program's start in 1995. Another two categories went up ("timber harvesting" and "wetlands") from 1995 but have marginally started to drop down in 2018 when comparing 2018 to 2013 and 2003. "Forest roads" are in a category all by themselves, where they showed great progress in 2003 from the 1995-1997 data but went back to having low *correct application* rates in both 2013 and 2018. It is important to remember that both the BMP Manual and BMP monitoring worksheets changed in the time between the 2003 and 2013 monitoring years. This makes it difficult to directly compare any of these two categories with each other because BMP monitoring teams were evaluating different questions within each category and overall.

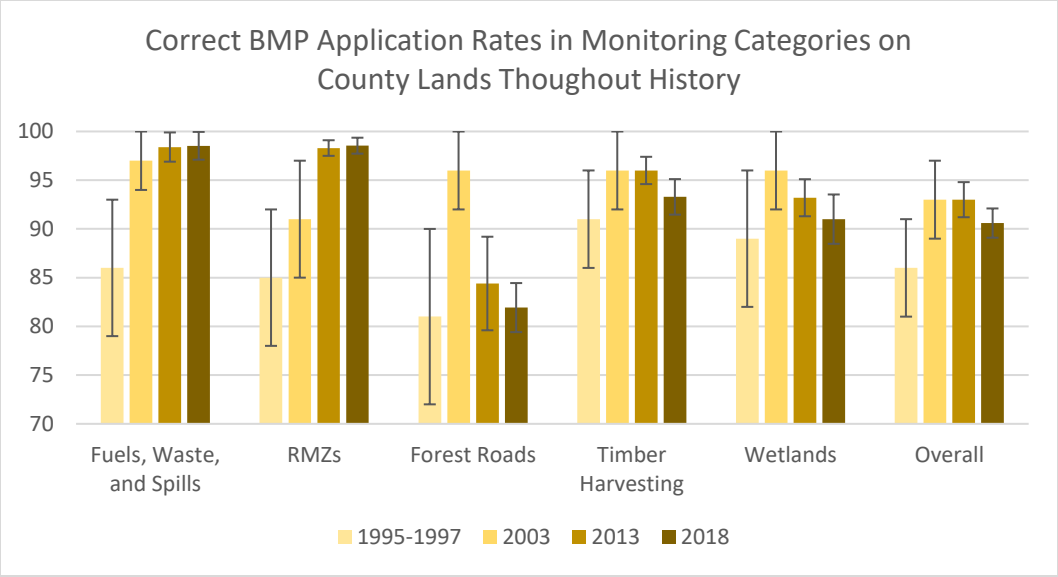


Figure 21. The different monitoring categories have varying *correct application* rates throughout the time county lands have been monitored under the BMP program.

State

The *correct application* for different monitoring categories on state lands has ended higher on every monitoring category when comparing 2018 to the baseline of 1995-1997 data. However, the monitoring categories don't all show a linear increase from past to present. "Fuels, waste, and spills" showed the greatest increase from 1995-1997 to 2003 and then only marginal increases after that. "Timber Harvesting" stayed very high all four years, whereas "wetlands" and "forest roads" had higher ratings during the '95-'97 monitoring then dropped in 2003 before increasing dramatically in 2013 and 2018.

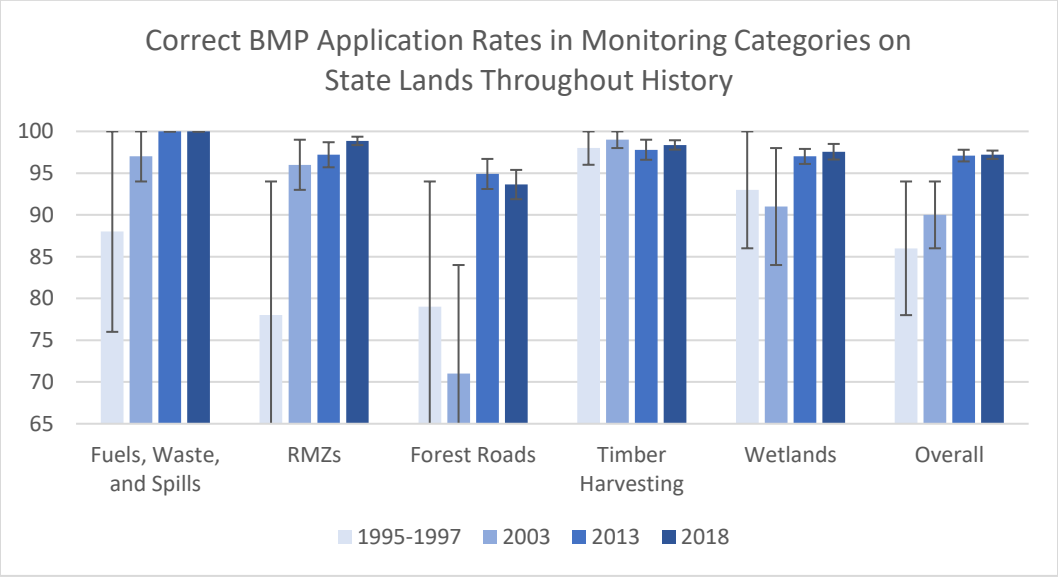


Figure 22. The different monitoring categories have varying application rates throughout the time state lands have been monitored under the BMP program.

BMP Effectiveness

After a BMP monitoring team decides whether or not a BMP is applicable to the site, they must decide how effective the respective BMP application is in protecting water quality. There are five different categorical effectiveness ratings that can be given to any BMP question that is found to be applicable:

- *No adverse impact* to water quality
- *Minor short-term* impact to water quality
- *Minor long-term* impact to water quality
- *Major short-term* impact to water quality
- *Major long-term* impact to water quality

The types of impacts, which describe the effectiveness of the BMPs, are conducted as qualitative measures. These evaluations reflect only the point in time for which the monitoring team is present. The monitoring teams are asked to use their best professional judgment as to what the type of impact the effectiveness of the BMP will have on water quality.

- *Short-term* may refer to an impact that lasts less than one year or recurring for a short period of time for multiple years.
- *Long-term* may refer to an impact that lasts more than one year or persist for a significant length of time for multiple years.
- *Minor* refers to a slight adverse impact on water quality
- *Major* refers to a significant adverse impact on water quality

By describing these impacts as a reflective point in time, it means that the best professional expertise is used to rate how an impact is occurring on a specific site at that current time. For example, a newly installed stream crossing that features an undersized culvert might be functioning well at the time of BMP monitoring. The team would be looking for evidence of overtopping, past road failures, and debris clogging the culvert. If none of these are currently exhibited by the site, this culvert would be rated as BMP *applied correctly* with *no adverse impact* to water quality for effectiveness. The teams will not take stream calculation measurements to determine the actual size of culvert needed but only take observational cues as evidence. The culvert, for all purposes, simply may not have been tested during a major storm event and will wash out during said storm event. This is the main reason that sites are not monitored immediately after harvest and are allowed at least one growing season to establish trends before BMP monitoring occurs. This also allows vegetation to regrow on the potential soil disturbance that occurred during the sale. Only the soil disturbance that fails to revegetate, which is also more likely to be a water quality impact, to be visible during BMP monitoring.

BMP Effectiveness for Correctly Applied BMPs

County

The county had extremely high effectiveness rates for protecting water quality when BMPs were *correctly applied*. Overall, the effectiveness was 99.9% when BMPs were *correctly applied* and four of the five monitoring categories had 100% effectiveness rates. Only "forest roads" had less than 100% and that was still 99.7%. This compares very similarly to 2013 where the overall effectiveness rates for *correct application* was 99.6%, only 0.3% lower than the 99.9% in 2018.

State

BMP effectiveness for the state when *correctly applying* BMPs was high as well at 99.6% overall. Two categories that did not have 100% effectiveness rates were "wetlands" and "timber harvesting" at 99.4% and 98.9%, respectively. This is down from 2013 data when every single category had 100% effectiveness rates. Both the state and the county effectiveness rates for 2018 continue to show that when BMPs are *applied correctly*, extremely high levels of water quality protection are achieved.

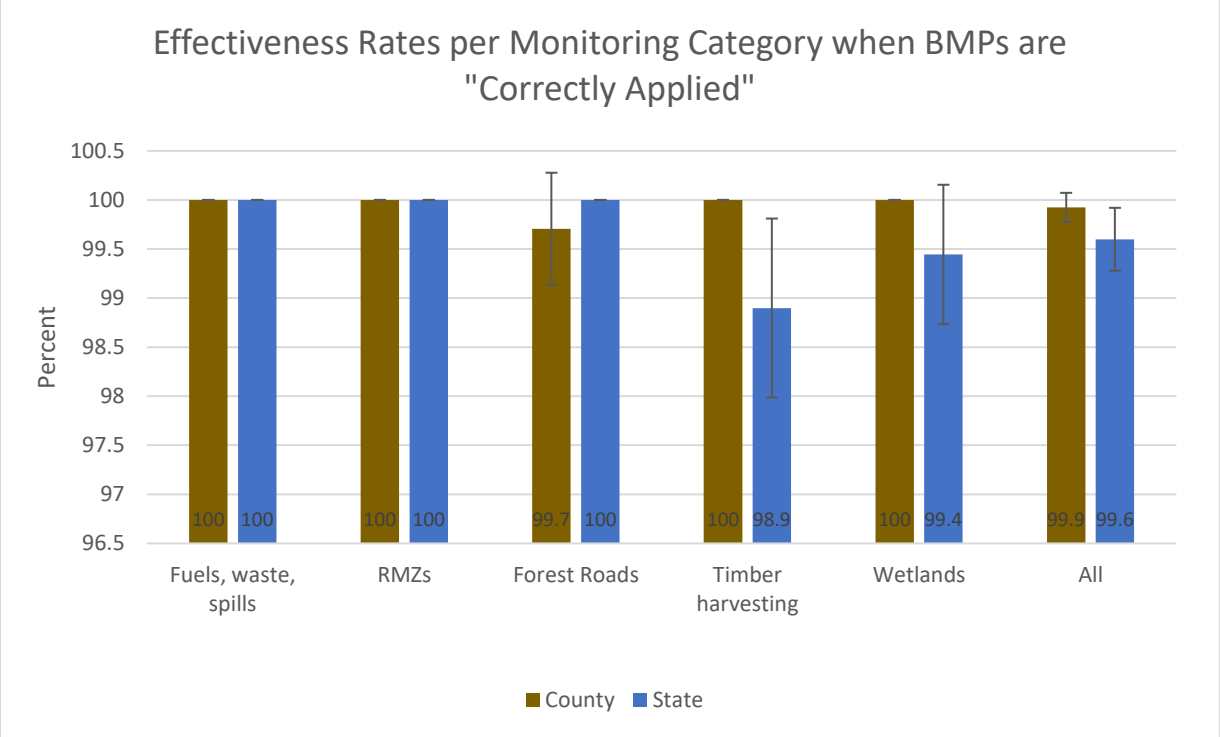


Figure 23. Effectiveness rates for different monitoring categories when BMPs are *correctly applied* to a site.

Figure 24. Shows a skid trail along the edge of a harvest boundary. Proper slash placement along with frozen soil helped the equipment not produce ruts in a wetland environment.

BMP Effectiveness for Not Applied BMPs

County

There is a much different story for protecting water quality when BMPs are *not applied* compared to when they are *applied correctly*. *No Adverse impacts* are observed to water quality only 30% of the time when BMPs should have been applied but they are not (Figure25). Over half the time, BMPs that are *not applied* where they should be led to *minor long-term* water quality impacts. *Minor short-term* impacts make up 15.6% of water quality impacts when BMPs are *not applied*. Despite the high rates of water quality impacts, when BMPs are *not applied*, no *major* impacts were observed on county land – *short* or *long* term. This is very impressive given the storm events discussed earlier. This year's data is very similar to 2013, where 36.1% *no adverse impacts* were listed when BMPs were *not applied*.

State

The state faired very similar to the county when comparing rates to the county. *No adverse impacts* were observed 30.6% of the time when BMPs were *not applied* where they were needed. They were more evenly split between *minor short-term* (25%) and *minor long-term* impacts (41.7%). There was a *major long-term* impact observed on state land, leading to the 2.8% in that category. That case involved a culvert that made the stream unnavigable to fish passage. In 2013 there were *no major impacts* recorded by the state, and *no adverse impacts* were observed far greater, at 76%. One element to note,

even with all the sites viewed and BMPs applicable to each site – few BMPs *not applied* are recorded. This shows and as the error bars in Figure 25 would indicate, that more deviation is expected from year to year due to the small sample size (which is a positive) of BMPs that are *not applied*.

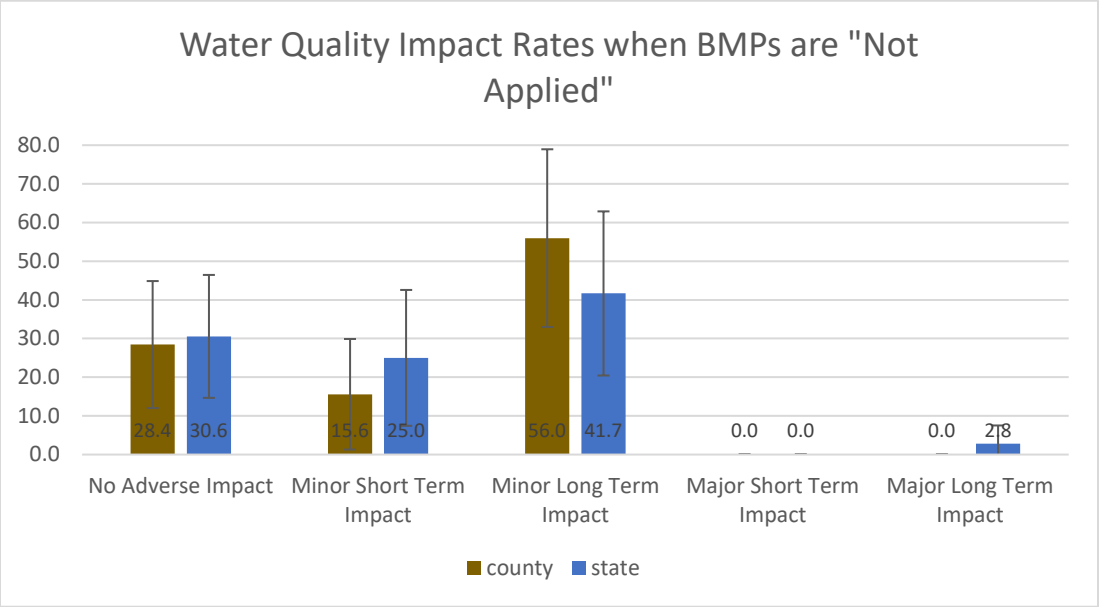


Figure 25. Water quality impact rates are broken down into the five effectiveness categories when BMPs are *not applied* where they are needed.

Figure 26. This photo illustrates a few main factors that commonly cause roads to degrade rapidly. High volume of water (rain) during 2018 compounded by the road's design/construction along with unregulated traffic all contributed to this road's degraded condition.

BMP Effectiveness in Different Application Categories

The vast difference between water quality impact rates for BMPs that were *applied correctly* vs. *not applied* are illustrated in figure 27. It shows that when BMPs are *correctly applied*, there is no adverse impact nearly 100% of the time and when they are *not applied*, impacts will be observed around 70% of the time. Figure 27 really shows protecting water quality from silvicultural activities is as straightforward as using BMPs correctly when deemed necessary but when they are not used, water quality impact rates skyrocket to approximately 70%.

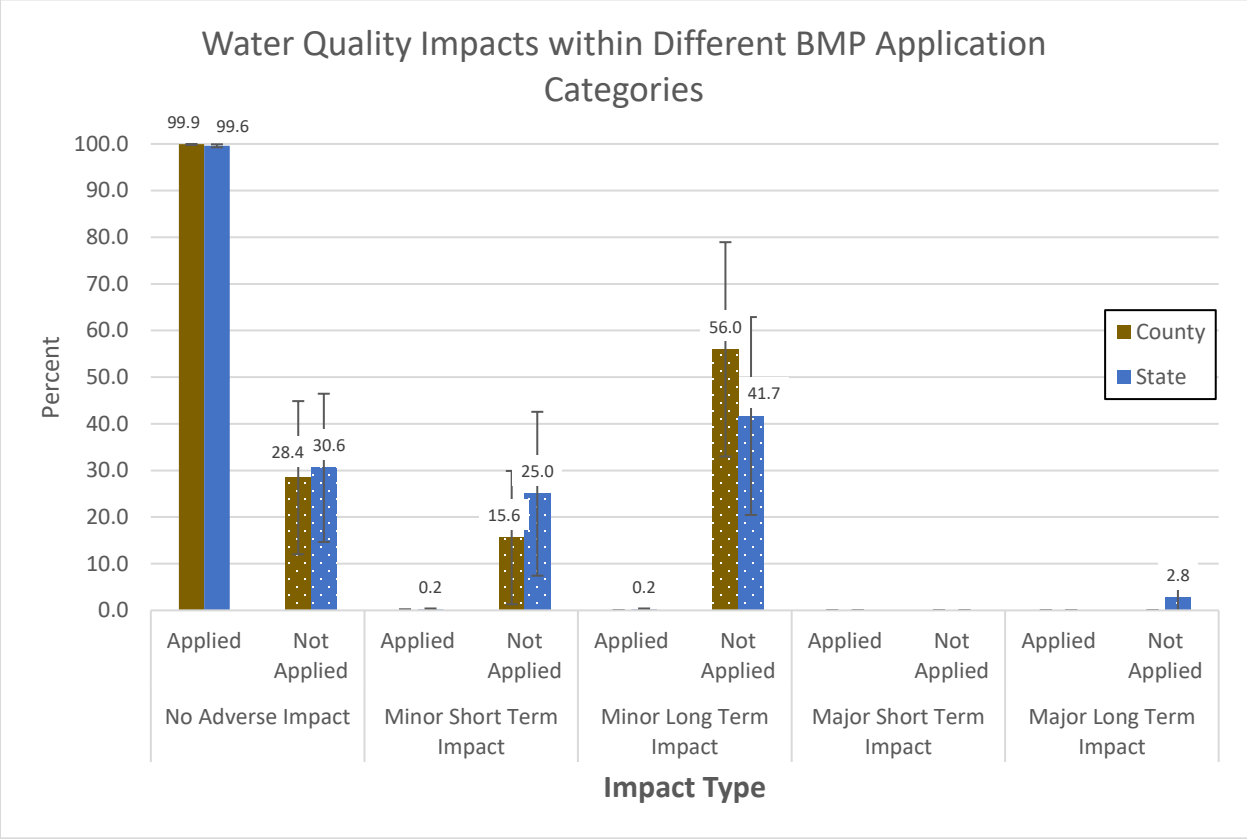


Figure 27. Water quality impacts are shown in the five BMP effectiveness categories when the application rates are either *applied correctly* or *not applied*.

Conclusion and Recommendations

The results from the 2018 BMP monitoring on state and county lands reveal that Wisconsin has developed a mature BMP program. 2018 signifies the fourth time county and state lands have been monitored – if the monitoring that took place between 1995-1997 is counted as one cycle. Even with the very slight drop in *correct application* rates observed on county lands, both state and county maintain high rates of *correct application*, above 90% and when BMPs are *applied correctly*, this protects water quality almost 100% of the time.

Just like past monitoring efforts, individual monitoring categories experience different levels of correct application, with "forest roads," once again being the lowest for both landowners. Today, forest roads are put under ever growing pressure to not only hold up to silviculture needs, but the expanding recreational demand from wheeled traffic – throughout multiple seasons. This year, many exceptionally large storms (in volume of precipitation) put extra strain on the forest road system. With recreational traffic and storms not showing any tendency to subside in future years, Wisconsin's best way to continue to improve water quality on state and county lands would be to focus on forest roads. Improving how roads are designed, built, and maintained for the appropriate, expected traffic according to the BMP manual will improve the correct application and therefore provide better water quality protection. Understanding that closing roads, either seasonally, or for certain recreational activities, may be the most financially sound way to achieve high water quality protection.

Minor impacts, both *short* and *long-term* are recorded when BMPs are *not applied correctly* – around 70% of the time. There was only one recorded *major* impact to water quality for the 72 sites observed, an indication that both state and county foresters are doing a great job implementing BMPs appropriate to each site. With the *minor* impacts being much more prevalent than major impacts, the focus should be applying the "little" elements of the BMP manual. Foresters, loggers, and contractors are doing an excellent job spending the extra time around highly sensitive areas like stream crossings and RMZs. To improve water quality rates, small elements like re-crowing forest roads after the sale, or installing broad based dips on even gradual slopes should be the focus going forward. These are the types on BMPs that are not always applied – partly because they are not always recognized as needed. Often time – they only become evident after an exceptionally wet, stormy, or heavily used season.

This reinforces the continued use of the BMP program and all its derivatives, which include:

- the education of BMPs to loggers, foresters, and landowners
- training monitoring teams to review harvest sites for BMP application and effectiveness
- producing reports to assess effectiveness and compliance with the BMP program
- Continue improving the BMP Field Manual and Monitoring Worksheet to incorporate new scientific findings on water quality and to ensure clear understanding of all BMP rules, guidelines, and goals.
- Discussion with the BMP Advisory Committee: which seeks to support and bolster Wisconsin's BMP program in order to protect water quality while addressing needs of the communities involved with and affected by silviculture.

Appendix A: Methods

Selection of Timber Harvests

There was a total of 234 sales cut on state lands and 583 sales cut on county forests that were able to be monitored for the 2018 BMP monitoring cycle. It was determined that 39 state sites and 32 county sites were needed to ensure a sample size that held statistical validity. A single stage cluster sampling method (which used each sale as a cluster) was used for analysis. By assuring that 39 state and 32 county sites were monitored, this report could confidently (95% confidence interval) assess the accuracy in that the monitoring results were a true representation of the total number of sites cut on state and county lands during the year 2013.

All the calculations for sample size determination and application and effectiveness analyses are run in a statistical computer program called R.

While it is helpful to have monitoring sites spread across the state – so they encompass the full variability of Wisconsin's diverse forest landscape – it is not a requirement as stated in "Water Resources" section. Rather, any site that meets the criteria for monitoring can be monitored and spatial relation to other monitoring sites is not taken into account.

Bias and Limitations

Bias, regarding BMP monitoring, is where one site is more likely to be selected than another regardless of eligibility criteria. This type of bias can result in a skewed depiction of the total sales and was limited to the best possible extent.

To prevent some areas of bias, all sites were entered into a spreadsheet where they were selected using a random number generator. All sites that were randomly selected were determined to be eligible for monitoring based on the set eligibility criteria found through the combination of: field checking, and satellite review through DNR Surface Water Data Viewer and Google Earth.

One minor way bias is introduced is by the eligibility criteria, it intentionally selects sites that have BMPs applicable to it and sites that are possible for teams to walk (less than ½ mile to the sales edge) or drive to. These intentional biases are brought in so that monitoring teams can focus on sites that have the most possible BMPs applicable and that they can monitor those sites in a time effective manner.

The last area of bias is one common to almost all BMP programs – how sites are rated for effectiveness at protecting water quality. The two elements that lead to bias through effectiveness ratings come from:

- how effective (or not effective) a BMP was is only judged as it is presented at a specific point in time to the monitoring teams
- being qualitative(observational) rather than quantitative(measurable)

When effectiveness is rated from a specific point in time, it only allows the monitoring team a narrow view of what could be happening on site. Variables as simple as snow cover, can make BMPs appear to be more or less effective than they actually were. More complicated variables, like scheduled maintenance on forest roads, can greatly increase the effectiveness of BMPs compared to when the monitoring teams evaluate the site.

When effectiveness is rated from a qualitative standpoint, it allows monitoring teams to be more flexible on how they rate a site. This allows for professional judgment of the team as a whole, and as individuals, be expressed as they rate the site for effectiveness. Bias is introduced because not every team or team member has the same professional judgment and they may rate sites different from other teams or individuals. The reason the ratings are done as a qualitative measure is because of time, practicality, and cost is greatly reduced compared to monitoring done using quantitative measures. One way to reduce this professional judgment bias is by the monitoring training held every year for individuals that participate in BMP monitoring. This allows for a greater consistency across individuals and monitoring teams for the recorded effectiveness.

Appendix B: Eligibility Criteria –Field Form

State of Wisconsin
DEPARTMENT OF NATURAL RESOURCES
101 S. Webster Street
Box 7921
Madison WI 53707-7921

Scott Walker, Governor
Dan Meyer, Secretary
Telephone 608-266-2621
Toll Free 1-888-936-7463
TTY Access via relay - 711

Eligibility Criteria - Field Form

2018 State and County Forestry BMP Monitoring

ID:_____ Date: _____

Landowner:_____ Landowner Phone:_____

County:_____ Township:_____

Legal Description: T _____ N, R _____ E / W, Section _____, _____ 1/4, _____1/4

GPS Lat/Long: _____

Eligibility Criteria:

1. Was harvesting completed within 200 feet of lake, river or stream? ❑ Yes ❑ No
2. Was at least one acre of wetland harvested? ❑ Yes ❑ No
3. Was a significant length of wetland crossed? ❑ Yes ❑ No
4. Was a stream crossed? ❑ Yes ❑ No
5. Is it less than a ½ mile walk to the timber sale? (required "yes") ❑ Yes ❑ No

Background Information:
If the timber sale has at least one "yes" in the eligibility criteria, please provide the following information, if known.

Site Conditions
Dominant Cover type:

❑ Spruce-Fir ❑ Aspen ❑ Pine Plantation ❑ Pine (not plantation)
❑ Maple-Basswood ❑ Oak-Hickory ❑ Bottomland Hardwoods

Dominant Topography:

❑ Flat (0-3%) ❑ Gently Rolling (4-9%) ❑ Rolling Hills (10-19%)
❑ Steep (20-45%) ❑ Very Steep (>45%)

Water Resources

Lake: ❑ Yes ❑ No

Name:_____ Size:_____

Stream: ❑ Yes ❑ No

Name:_____ ❑ Perennial ❑ Intermittent

Navigable: ❑ Yes ❑ No Trout Stream: ❑ Yes ❑ No

Wetlands: ❑ Yes ❑ No

Area Harvested:_____ Length Crossed:_____

Springs: ❑ Yes ❑ No Seeps: ❑ Yes ❑ No

Approximate Number: _____ Approximate Number:_____

Notes about water resources:_____

_____

_____

_____

Access to Site

Gated entrance: ❑ Yes ❑ No

Contact Information for Access:_____

Recommended Driving Directions to site/parking location:_____

_____

Is 4-wheel drive or a high clearance vehicle needed to access site? ❑ Yes ❑ No

Sale Information

Forester/Timber Sale Administrator:_____

Contact Information:_____

Logger:_____Master Logger: ❑ Yes ❑ No

Contact Information:_____

Date Harvested:_____

Logging Equipment Used:_____

Was any equipment tracked? ❑ Yes ❑ No

Harvest System Used: ❑ Clear-cut ❑ Shelterwood ❑ Salvage ❑ Thinning/Selection

❑ Other:_____

Approximate Acres Harvested:_____

Appendix C: 2013 BMP Monitoring Teams

Team Frances: Daniel Buckler, Mark Heyde, James Brozeller, Kathryn Thostenson

Team Keith: Mark Diesen, Chris Martin, Ben Baumgart, Jeff Nyquist

Team Charley: Joseph Kies, Denise Krentz, Aaron Wallace, Bob Puent

Team Fabian: Justin Kania, Ryan Peaslee, Cale Severson, Paul Cunningham

Team Isabel: David Boyarski, Katherine Lenz, Tim James, Jonathan Pyatskowit

Team Wilma: Chris Bender, Mike Fitz, Ron Weber, Peter Anderson

Team Katrina: Dave Kafura, Ruth King, Kevin Croteau

Team Michelle: Jacob Coonen, Nicky Martin, Joseph LeBouton, Kara Oikarinen

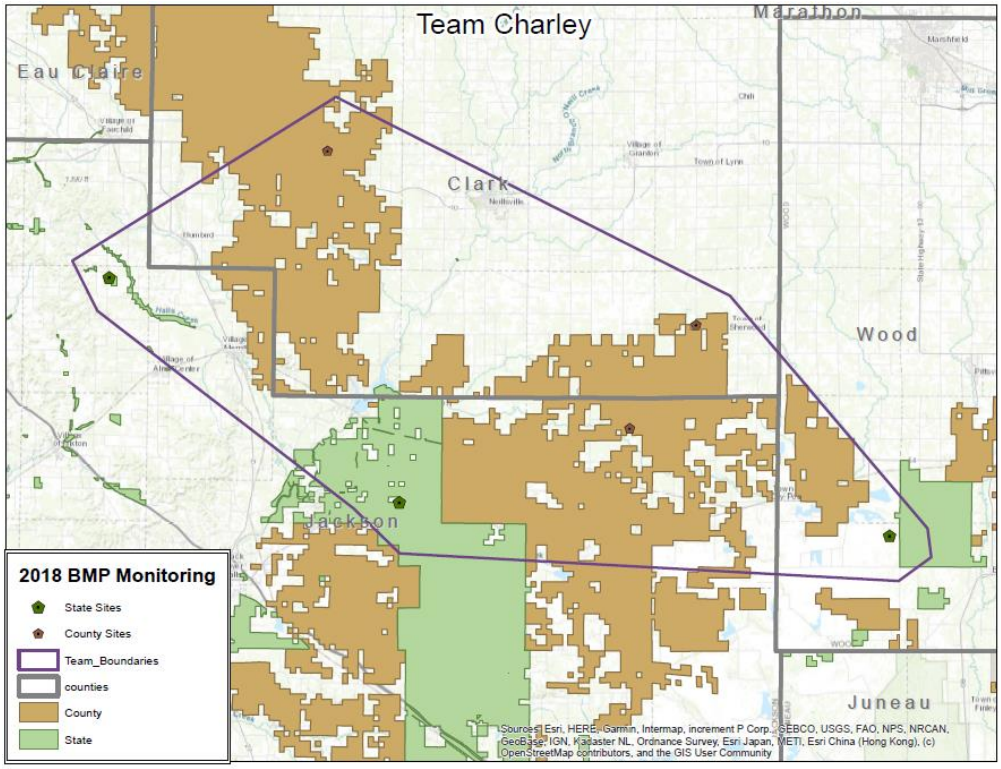
Team Ivan: Nolan Kriegel, Jenna Kosnicki, Roberta Kunzman, Jennifer Jefferson

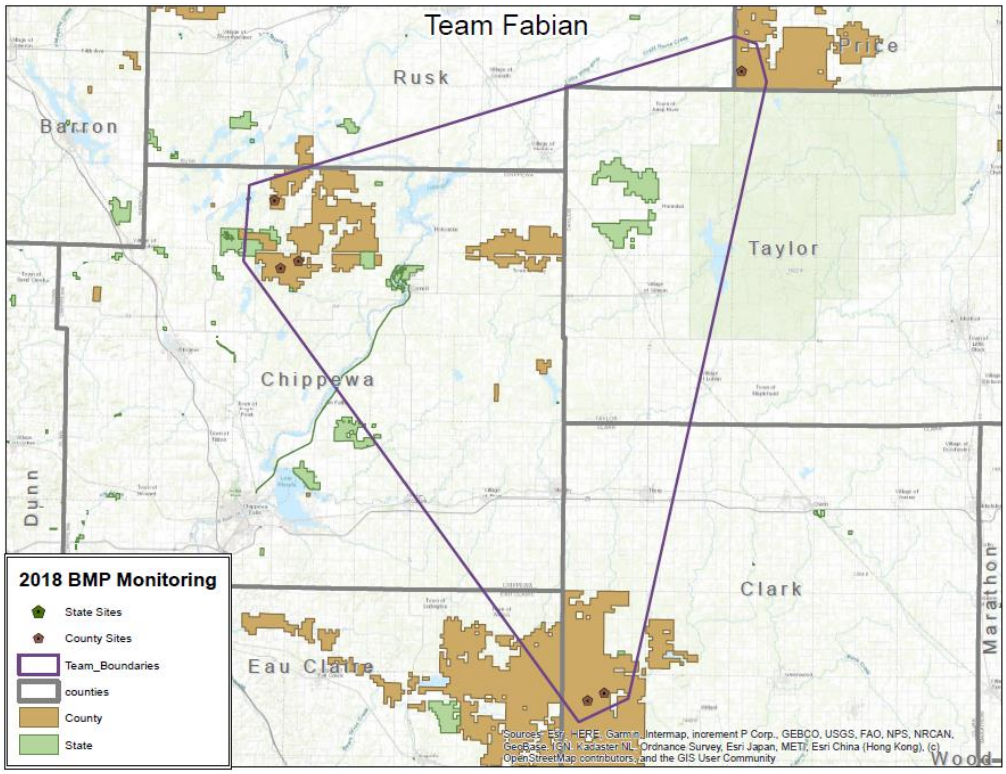
Team Lili: Matt Slater, Bethany Polchowski, Adam Fuehrer, Darrell Pierson

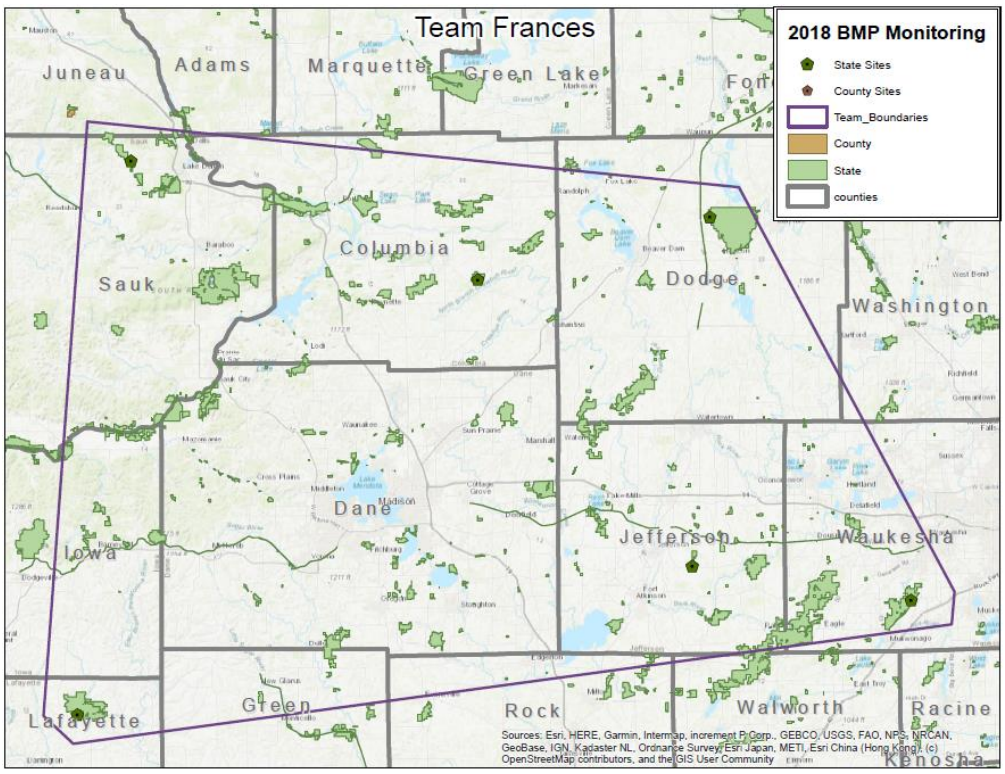
Team Rita: Andy Stoltman, Teresa Pearson, Katrina Walker-Daniels, Laura Reuling

*Team Leaders are underlined.

Appendix D: Team Maps



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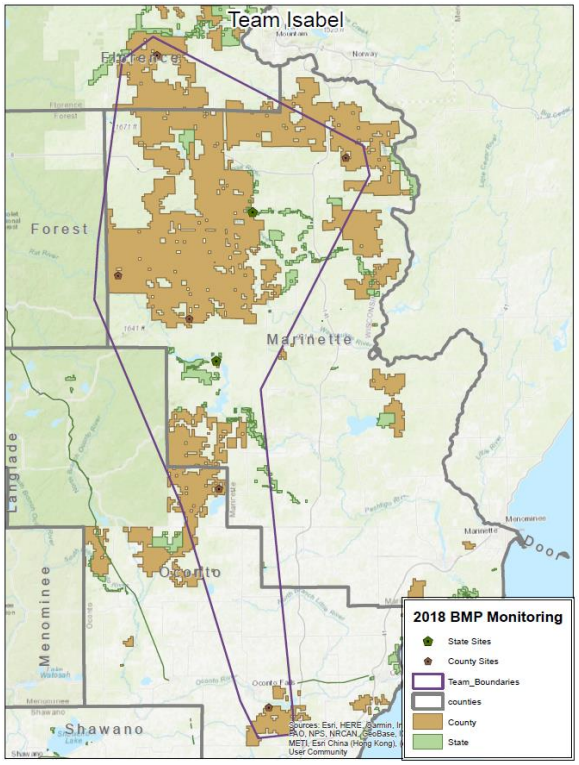
2018 BMP Monitoring
State Sites
County Sites
Team_Boundaries
County
State
counties
Juneau
Adams
Marquette
Green Lake
Fond
Columbia
Sauk
Dodge
Washington
Dane
Jefferson
Waukesha
Iowa
Lafayette
Green
Rock
Walworth
Racine
Kenosha
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community


Team Isabel
Florence
Forest
Marinette
Langlade
Oconto
Menominee
Door
Shawano
2018 BMP Monitoring
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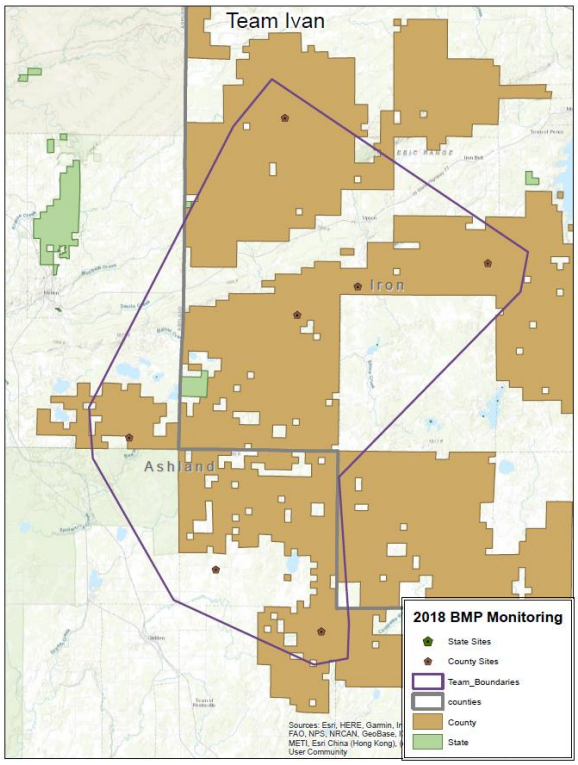
County Sites
Team_Boundaries
counties
County
State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Iron
Ashland
2018 BMP Monitoring
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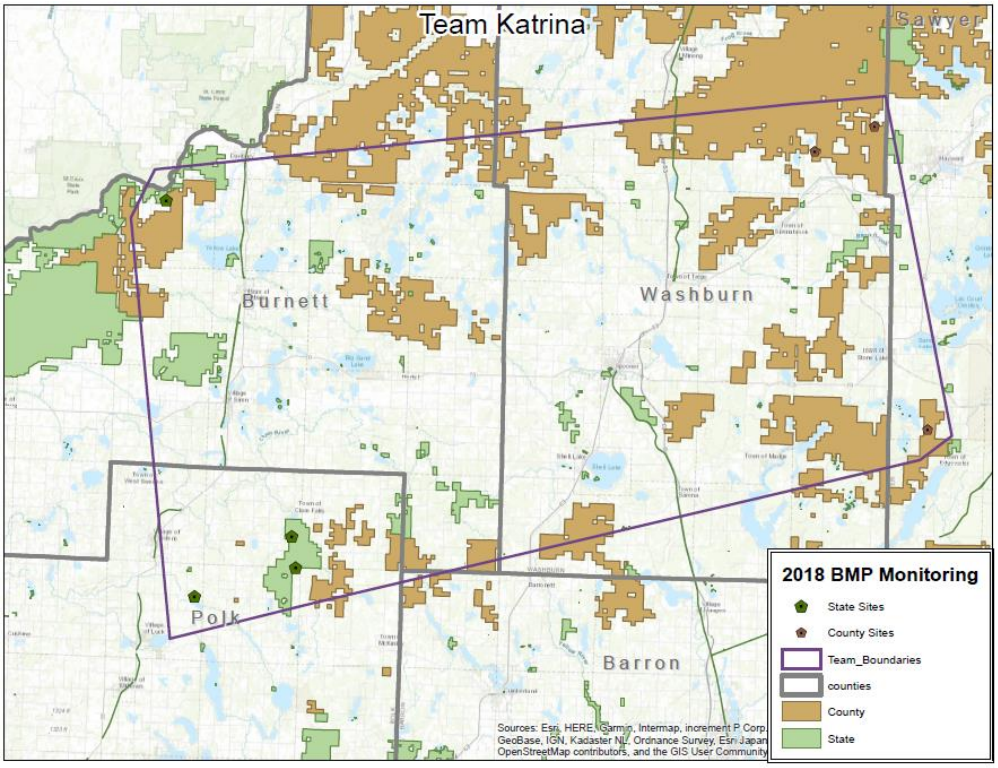
counties
County
State


Team Katrina
Sawyer
Burnett
Washburn
Polk
Barron
2018 BMP Monitoring
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County Sites
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counties
County
State
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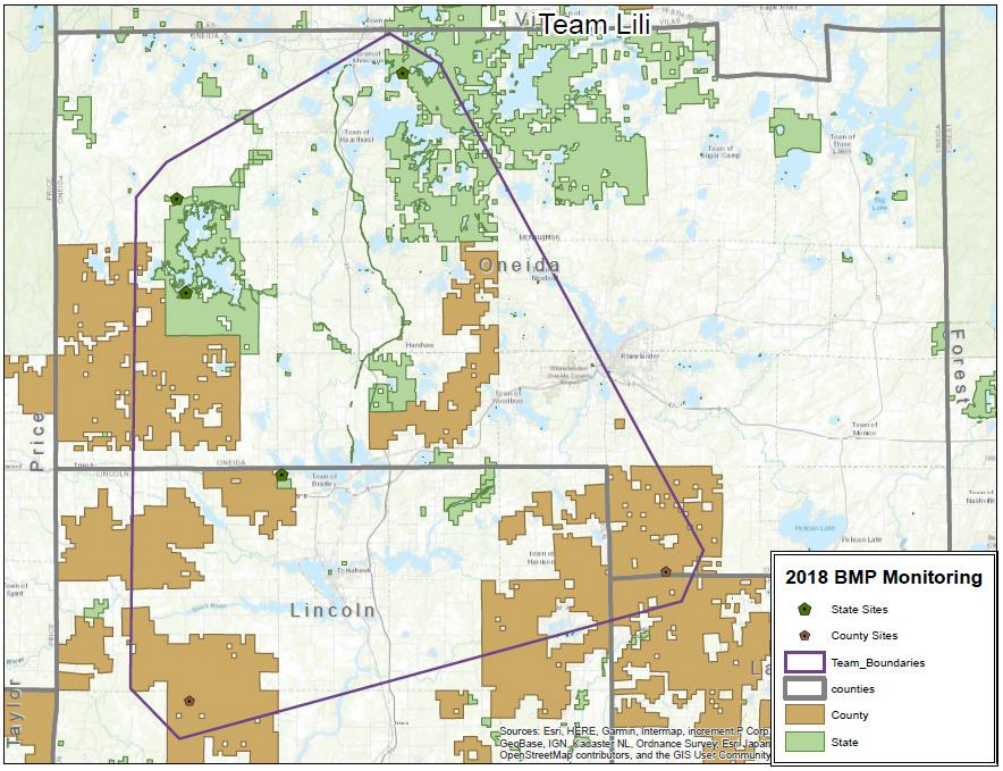
GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan
OpenStreetMap contributors, and the GIS User Community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Oneida
Forest
Price
Lincoln
Taylor
2018 BMP Monitoring
State Sites
County Sites
Team_Boundaries
counties
County
State
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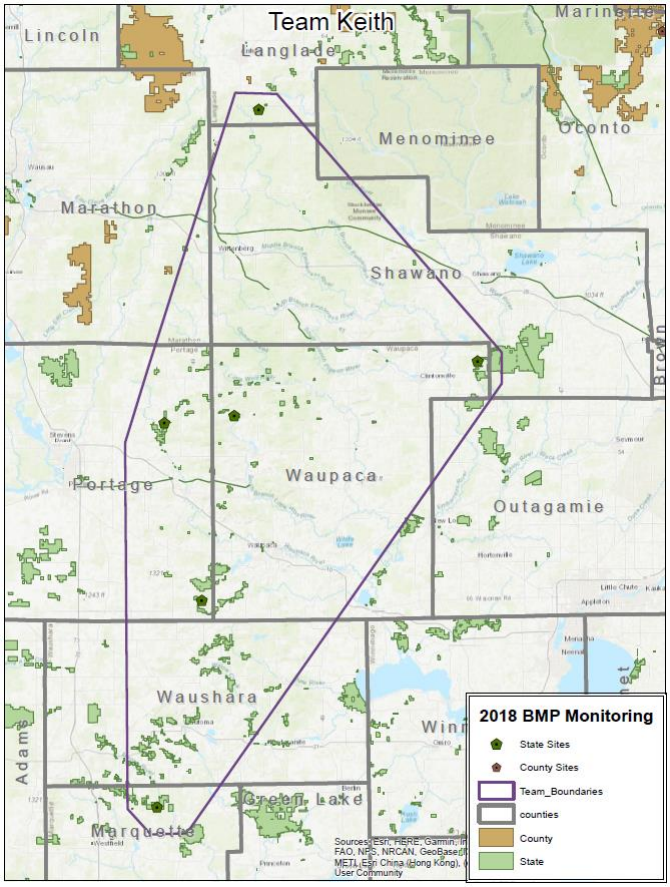
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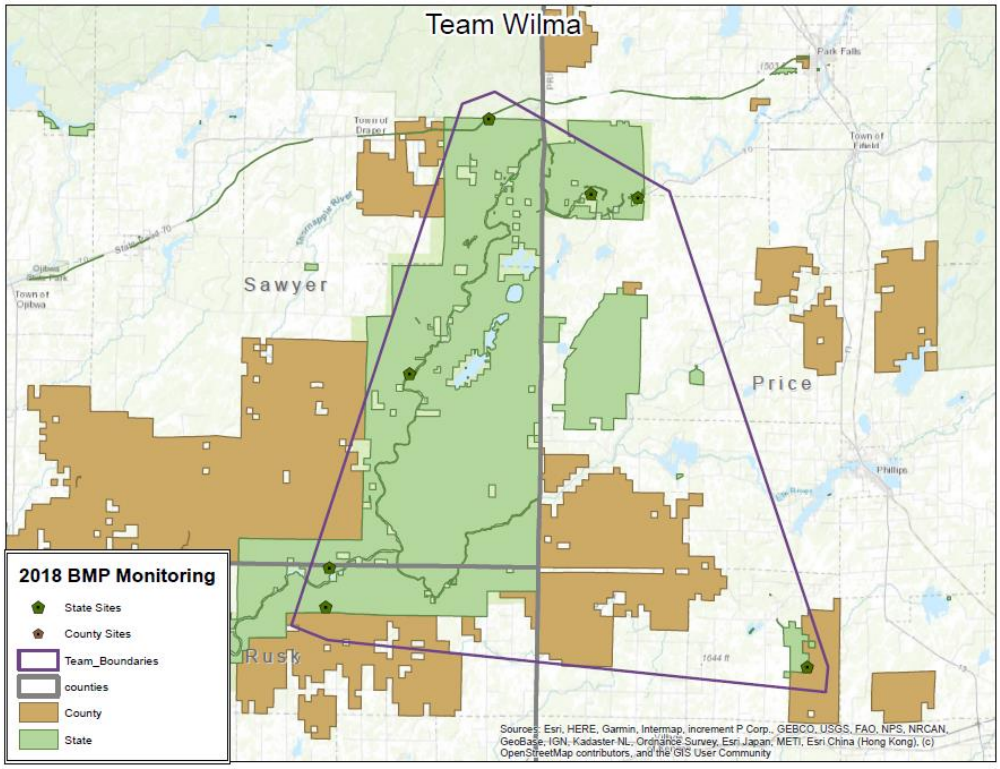
Lincoln
Langlade
Menominee
Oconto
Marathon
Shawano
Brown
Portage
Waupaca
Outagamie
Waushara
Adams
Green Lake
Marquette
2018 BMP Monitoring
State Sites
County Sites
Team_Boundaries
counties
County
State


Team Wilma
Park Falls
Town of Draper
Town of Fifield
Sawyer
Price
Phillips
Rusk
2018 BMP Monitoring
State Sites
County Sites
Team_Boundaries
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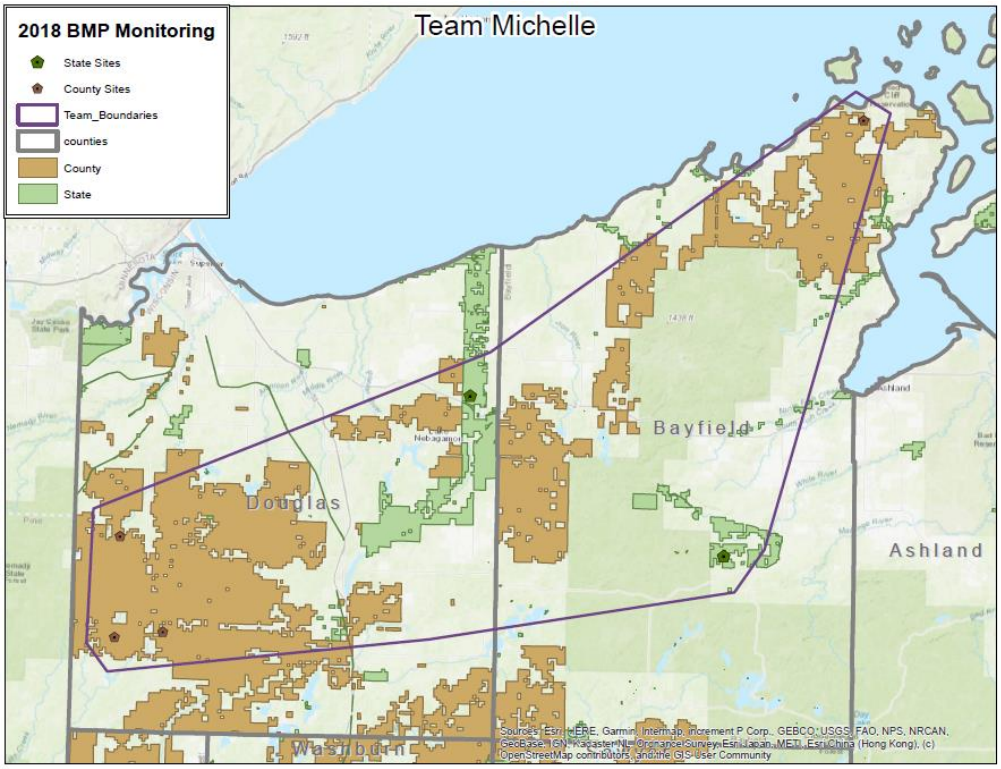
County
State
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community


Team Michelle
2018 BMP Monitoring
State Sites
County Sites
Team_Boundaries
counties
County
State
Bayfield
Douglas
Ashland
Washburn
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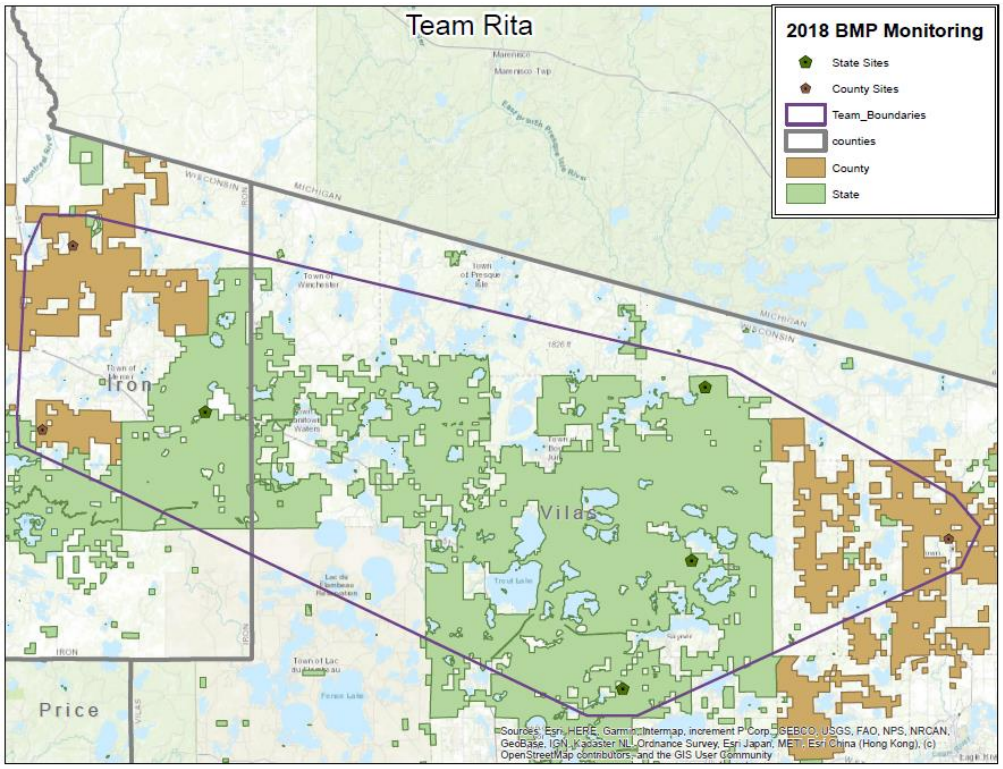
Team Rita
2018 BMP Monitoring
State Sites
County Sites
Team_Boundaries
counties
County
State
Iron
Vilas
Price
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2018 BMP Monitoring Worksheet

for Wisconsin's Forestry Best Management Practices for Water Quality

Objectives of BMP Monitoring

1) Determine the extent to which BMPs were applied on the selected sites.
2) Determine the effectiveness of properly applied BMPs in protecting water quality on the selected sites.
3) Determine the effects of not applying BMPs where needed on the selected sites.
4) Obtain descriptive information about RMZs and buffer strips (where present) with respect to size, vegetative composition, and past use.

The results of these objectives from BMP Monitoring will be used to:

* Identify trends
* Identify where modifications may be needed in the BMP field manual
* Identify research and information needs
* Educate landowner, loggers and foresters involved in the sites that are monitored
* Compare and contrast with other landowner categories

Timber Sale ID: _____

Landowner Name: _____

Date: _____

Team:

Ivan	Michelle	Lili
Frances	Keith	Charley
Wilma	Fabian	Isabel
Katrina	Rita	

Non-Team Members: _____

Age of Harvest:
❑ Less than 1 y.o. ❑ 1 to 2 y.o. ❑ More than 2 y.o.
❑ Unknown ❑ Multiple years

Acres Harvested: _____

Weather Conditions:
❑ Sunny ❑ Partly Sunny ❑ Cloudy/Overcast
❑ Rain ❑ Snow ❑ Drought

Any Extreme or Rare Weather Events?
❑ Yes ❑ No
Please explain:

APPLICATION Was the BMP applied at the sale? 1 -- BMP applied correctly 2 -- BMP applied but incorrectly 3 -- BMP not applied 4 -- Insufficient information to rate X -- BMP not applicable to the site (site or harvest conditions not found on site)	**EFFECTIVENESS** What effect did applying (or not applying) the BMP have? 1 -- No adverse impact 2 -- Minor short-term impact 3 -- Minor long-term impact 4 -- Major short-term impact 5 -- Major long-term impact X -- Effectiveness rating not applicable

BEST MANAGEMENT PRACTICES	**APPLICATION**	**EFFECTIVENESS**	**COMMENTS/IMPACT**
A. Fuels, Lubricants, Waste and Spills			
Fuels, Lubricants, and Waste (p. 115)			
1. Designate specific areas for equipment maintenance and fueling. Locate these areas on level terrain, a minimum of 100 feet from all streams and lakes.			
2. Collect all waste lubricants, containers, and trash (i.e. grease cartridges).			
B. Riparian Management Zones			
BMPs Common to All Three RMZ Categories (p. 90)			
B-a. Is there a lake or stream present in the area monitored for the timber sale? (Check all that apply.)	❑ Yes – lake(s). ❑ Yes – stream(s). Go to next question.		❑ No. Go to Section C – Forest Roads.
3. Locate roads outside the RMZ, unless necessary for stream crossings.			
4. Locate landings outside the RMZ.			
5. Do not dispose of or pile slash within the RMZ.			
6. Minimize soil exposure and compaction to protect ground vegetation and the duff layer.			
B-b. Did harvesting occur within the RMZ?	❑ Yes.		❑ No.
B-c. If harvesting occurred within the RMZ, what type of equipment was used?			
BMPs for Lakes, Designated Trout Streams, & Streams 3' Wide & Wider (100' RMZ) (p. 91)			
B-d. Is there a lake, designated trout stream, or stream 3' wide or wider in or adjacent to the harvest area of the timber sale?	❑ Yes. Go to next question.		❑ No. Go to Question B-i.
7. Do not operate wheeled or tracked equipment within 15 feet of the ordinary high water mark (OHWM) except on roads or at stream crossings.			
8. Operate wheeled or tracked equipment within 15 to 50 feet of the OHWM when the ground is frozen or dry.			
9. Do not harvest fine woody material within 50 feet of the OHWM.			
10. Use selection harvests and promote long-lived tree species appropriate to the site.			
11. Harvesting intervals should be a minimum of every 10 years.			

12. Harvesting plans should leave at least 60 ft^2 of basal area per acre in trees 5 inches DBH and larger, evenly distributed.			
13. Develop trees 12 inches DBH and larger.			
B-e. The RMZ width….	❑ Meets the minimum standard of 100 feet. ❑ Exceeds the minimum standard of 100 feet. ❑ Is less than the minimum standard of 100 feet. ❑ An RMZ was not used.		
B-f. If the RMZ width was modified, it was…	❑ Increased _____ feet. ❑ Decreased _____ feet.		
B-g. The basal area retained within the RMZ was…	❑ 0 – 20 sq. ft./acre ❑ 20 – 40 sq. ft./acre ❑ 40 – 60 sq. ft./acre ❑ 60 – 80 sq. ft./acre ❑ More than 80 sq. ft./acre		
B-h. The **pre-harvest** condition of the RMZ was…	❑ Forested the entire width ❑ Forested greater than 50% of the width ❑ Forested less than 50% of the width ❑ Not forested (tag alders or sedge meadow)		
BMPs for Stream Less Than 3' Wide (35' RMZ) (p. 92)			
B-i. Is there a stream less than 3 feet wide in or adjacent to the harvest area of the timber sale?	❑ Yes. Go to next question.	❑ No. Go to Question B-n.	
14. Operate wheeled or tracked harvesting equipment within 15 feet of the ordinary high water mark (OHWM), only when the ground is frozen or dry.			
15. Do not harvest fine woody material within 15 feet of the OHWM.			
16. Use selection harvests and promote long-lived tree species appropriate to the site.			
17. Harvesting intervals should be a minimum of every 10 years.			
18. Harvesting plans should leave at least 60 ft^2 of basal area per acre in trees 5 inches DBH and larger, evenly distributed.			
B-j. The RMZ width….	❑ Meets the minimum standard of 35 feet. ❑ Exceeds the minimum standard of 35 feet. ❑ Is less than the minimum standard of 35 feet. ❑ An RMZ was not used.		
B-k. If the RMZ width was modified, it was…	❑ Increased _____ feet. ❑ Decreased _____ feet.		
B-l. The basal area retained within the RMZ was…	❑ 0 – 20 sq. ft./acre ❑ 20 – 40 sq. ft./acre ❑ 40 – 60 sq. ft./acre ❑ 60 – 80 sq. ft./acre ❑ More than 80 sq. ft./acre		
B-m. The **pre-harvest** condition of the RMZ was…	❑ Forested the entire width ❑ Forested greater than 50% of the width ❑ Forested less than 50% of the width ❑ Not forested (tag alders or sedge meadow)		

BMPs for Streams Less Than 1' Wide (35' RMZ) (p. 93)		
B-n. Is there a stream less than 1 foot wide in or adjacent to the harvest area of the timber sale?	❑ Yes. Go to next question.	❑ No. Go to Section C – Forest Roads.
19. Operate wheeled or tracked harvesting equipment within 15 feet of the ordinary high-water mark (OHWM) only when the ground is frozen or dry.		
20. Do not harvest fine woody material within 15 feet of the OHWM.		
B-o. The RMZ width….	❑ Meets the minimum standard of 35 feet. ❑ Exceeds the minimum standard of 35 feet. ❑ Is less than the minimum standard of 35 feet. ❑ An RMZ was not used.	
B-p. If the RMZ width was modified, it was…	❑ Increased _____ feet. ❑ Decreased _____ feet.	
B-q. The basal area retained within the RMZ was…	❑ 0 – 20 sq. ft./acre ❑ 20 – 40 sq. ft./acre ❑ 40 – 60 sq. ft./acre ❑ 60 – 80 sq. ft./acre ❑ More than 80 sq. ft./acre	
B-r. The **pre-harvest** condition of the RMZ was…	❑ Forested the entire width ❑ Forested greater than 50% of the width ❑ Forested less than 50% of the width ❑ Not forested (tag alders or sedge meadow)	

C. Forest Roads

Location and Design of Forest Roads (p. 37 & 44)		
C-a. Was there a forest road system for this timber sale?	❑ Yes. Go to next question.	❑ No. Go to Section D – Timber Harvesting.
C-b. What best describes the forest road design? (Check all that apply.)	❑ Crowned ❑ Out-sloped	❑ In-sloped ❑ Flat
C-c. What best describes the predominant construction of forest roads?	❑ Roads are below the grade of adjoining land. ❑ Roads are at grade with no ditch constructed. ❑ Roads have an excavated ditch less than 1 foot deep. ❑ Roads have an excavated ditch greater than 1 foot deep. ❑ Roads were created by cut and fill on side slopes. ❑ Roads were constructed of fill material with no excavation. ❑ Roads are a combination of these types.	
C-d. Was there an existing forest road system for this timber sale?	❑ Yes. Go to next question.	❑ No. Go to Question C-e.
21. Use existing roads when they provide the best long-term access.		
C-e. Were forest roads constructed or improved for this timber sale?	❑ Yes. Go to next question.	❑ No. Go to Question C-f.
22. Select road locations that allow for drainage away from the road.		

23. Where possible, locate roads on well-drained soils.			
24. Minimize the number of stream, dry wash, and wetland crossings.			
25. Locate roads outside of riparian management zones and wetland filter strips, except at crossings			
26. Road grades should not exceed 10%. If road grades greater than 10% are necessary, limit grade length or break the grade using drainage structures.			
27. Construct roads to follow natural contours and minimize cut and fills.			
28. Construct roads to remove water from road surfaces.			
29. Construct stable cut and fill slopes that will re-vegetate easily, either naturally or artificially.			
30. Do not bury debris in the road base.			
Drainage Structures on Forest Roads (p. 53)			
C-f. Were new or existing drainage structures located on forest roads?	❑ Yes. Go to next question.		❑ No. Go to Question 38.
31. Install drainage structures to remove water from road surface and ditches.			
32. Install a berm at the inlets of drainage structures, if needed, to direct water into the structures.			
33. Provide erosion protection at the outlets of drainage structures to minimize erosion and disperse the water.			
34. Install drainage structures at grades of at least 2% more than the ditch grade and at a 30 to 45 degree angle to the road.			
35. Check drainage structures to ensure that they are not filling with sediment or other debris. Clean if needed.			
C-g. What types of drainage structure were used on the road system? (check all that apply)	❑ New cross drain culvert(s). Go to Question 36. ❑ Existing cross drain culvert(s) ❑ New open-top culvert(s) ❑ Existing open-top culvert(s) ❑ New broad-based dip(s). Go to Question 37. ❑ Existing broad-based dip(s) ❑ New water bar(s) ❑ Existing water bar(s) ❑ New diversion ditch(es) ❑ Existing diversion ditch(es) ❑ No drainage structures were used		
Cross Drain Culverts for Drainage on Forest Roads (pp. 54)			
36. Install cross drain culverts long enough to extend beyond the road fill.			
Broad-based Dips for Drainage on Forest Roads (p. 54)			
37. Construct broad-based dips deep enough to provide adequate drainage and wide enough to allow trucks and equipment to pass safely.			
Soil Stabilization on Forest Roads (p. 56)			
38. Use seed, mulch and/or erosion control netting where necessary to minimize soil erosion into lakes, streams and wetlands. See Tables 4-3 and 4-4.			

39. Install sediment control structures where necessary to slow the flow of runoff and trap sediment until vegetation is established at the sediment source. See Tables 4-3 and 4-4.			
40. Maintain, clean and/or replace sediment control structures until areas of exposed soil are stabilized.			
Forest Road Maintenance – Active Forest Roads (p. 61)			
C-h. Does the forest road system include active roads? Roads are considered active if they continue to be used by the landowner and/or public for multiple uses, such as forest management, hunting and recreation.	❑ Yes. Go to next question.		❑ No. Go to Question C-i.
41. Inspect the road system at regular intervals. Clear debris from drainage structures to prevent clogging that can lead to washouts.			
42. Keep traffic to a minimum during wet periods and spring break-up to reduce maintenance needs.			
43. Shape road surfaces periodically to maintain proper surface drainage. Fill in ruts and holes with gravel or compacted fill as soon as possible to reduce erosion potential.			
44. Remove berms along the edge of the road if they will trap water on the road.			
45. When dust control agents are used, apply them in a manner that will keep these compounds from entering lakes, stream and groundwater.			
Forest Roads Maintenance – Inactive Forest Roads (p. 62)			
C-i. Does the forest road system include inactive roads? Inactive roads are not used for extended periods of time and may be closed by gates, berms, boulders, pits or other measures that make vehicle passage unlikely in order to protect the road surface and water protection measures. In some instances, the length of time and/or reason for closure may be posted and acceptable uses may be invited to assure compliance with the road closure.	❑ Yes. Go to next question.		❑ No. Go to Question C-j.
46. Remove all temporary drainage and crossing structures.			
47. Shape all road system surfaces to maintain proper surface drainage, if necessary.			
48. Inspect and maintain road surfaces, drainage structures, and crossings to minimize erosion.			
General BMPs for Stream Crossings on Forest Roads (p. 67-68)			
C-j. Was a stream crossed in forest road system?	❑ Yes. Go to next question.		❑ No. Go to Section D – Timber Harvesting.
C-k. Which of the following best describe the stream crossing?	❑ New crossing used. Go to next question. ❑ Existing stream crossing used. Go to Question 55. ❑ Both new and existing stream crossings used. Go to next question.		

49. Identify optimum stream crossing locations: straight and narrow stream channels; low banks; firm rocky soil; keep approaches at the least gradient possible.			
50. Install stream crossing structures at right angles to the stream channel.			
51. Install stream crossings using materials that are clean, non-erodible and non-toxic to aquatic life.			
52. Minimize channel changes and the amount of excavation or fill needed at the crossing.			
53. Limit construction activity in the streambed to periods of low or normal flow. Keep use of equipment in the stream to a minimum.			
54. Use soil stabilization practices on exposed soil at stream crossings.			
55. Design, construct and maintain stream crossings to avoid disrupting the migration/movement of fish and other aquatic life.			
56. Use diversion ditches, broad-based dips, or other practices on the road approaches to prevent road runoff from entering the stream.			
57. Stabilize approaches to crossings with aggregate or other suitable material to reduce sediment entering the stream.			
C-l. What type of stream crossings were used in the forest road system?	❑ Bridges ❑ Culverts ❑ Fords ❑ Pole fords (PVC or logs) ❑ Timber mats ❑ Frozen snow/ice crossing ❑ Other: _____ ❑ Stream crossed without any structure		
Stream Crossing BMPs for Culverts on Forest Roads (p.69)			
C-m. Were culverts used as stream crossing structures on the forest roads?	❑ Yes. Go to next question.	❑ No. Go to Question C-o.	
C-n. Which of the following best describe the stream crossing structure(s)?	❑ New culvert(s) were installed. Go to next question. ❑ Existing culvert(s) were used. Go to Question 63. ❑ Both new and existing culvert(s) were used. Go to next question.		
58. Install culverts that extend at least 1 foot beyond the road fill.			
59. Install culverts that are large enough to pass flood flows.			
60. Install culverts so there in no change in the stream bottom elevation. Culverts should not dam or pool water.			
61. Firmly compact material around culverts, particularly the bottom half. To prevent crushing, cover the top of culverts with fill to a depth of 1/3 the culvert diameter or at least 12 inches, whichever is greater.			
62. Use riprap around the inlet and outlet of culverts to prevent water from eroding and undercutting the culvert.			

63. Keep culverts clear and free of debris so that water can pass unimpeded at all times.			
Stream Crossing BMPs for Fords on Forest Roads (p. 70)			
C-o. Were fords installed as stream crossing structures on the forest roads?	❑ Yes. Go to next question.		❑ No. Go to Question C-p.
64. Locate fords where stream banks are low.			
65. Locate where the stream bed has a firm rock or gravel streambed.			
Temporary Stream Crossing BMPs on Forest Roads (p. 71)			
C-p. Were temporary stream crossing structures installed on the forest roads?	❑ Yes. Go to next question.		❑ No. Go to Section D – Timber Harvesting.
66. Use temporary stream crossings such as timber mats, pole fords, or frozen fords when appropriate.			
67. Anchor temporary structures on one end with a cable or other device so they do not float away during high water.			
D. Timber Harvesting			
Landings BMPs (p. 74)			
D-a. Were there any existing landings available for this timber sale?	❑ Yes. Go to next question.		❑ No. Go to Question 69.
68. Use existing landings if possible.			
69. Locate landings on frozen ground or on firm well-drained soils with a slight slope or that have been shaped to promote efficient drainage.			
70. Locate residue piles (sawdust, chipping residue, and other material) away from areas where runoff may wash residue into streams, lakes or wetlands.			
Skid Trail BMPs (p. 39)			
71. Where possible, keep skid trail grades less than 15%. Where steep grades are unavoidable, break the grade and install drainage structures at recommended intervals. Grades greater than 15% should not exceed 300 feet in length.			
72. Use existing skid trails if they provide the best long-term access.			
General Timber Harvesting BMPs (p. 76)			
73. Limit the length and number of skid trails, landing, and stream crossing to the minimum necessary for conducting the harvest operation and to meet the landowner's objectives.			
74. Whenever possible, winch logs up steep slopes if conventional skidding could cause erosion that affects water quality.			
75. Avoid operating equipment where excessive soil compaction, rutting, or channelized runoff may cause erosion that affects water quality.			

76. Fill in ruts, apply seed and mulch, and install sediment control structures and drainage structures on skid trails and landings where needed to prevent erosion and sedimentation into surface waters.			
77. Inspect soil stabilization practices periodically during and after harvest operations to insure that they are successful and remain functional.			
78. Do not dispose of or pile slash in areas where runoff may wash slash into lakes, streams, or wetlands.			
79. For winter harvesting, mark stream channels, dry washes, and existing culvert locations before snowfall.			
Dry Wash BMPs (p.78)			
D-b. Are there any dry washes associated with the timber harvest?	❑ Yes. Go to next question.		❑ No. Go to Question D-c.
80. Use selection harvests or patch clear-cuts within 35 feet of the dry wash to promote tree species appropriate to the site.			
81. Avoid locating roads and landings within 35 feet of the dry wash unless necessary for crossings.			
82. Operate wheeled or tracked equipment within 15 feet of the dry wash only when the ground is frozen or dry.			
83. Do not harvest fine woody material within 15 feet of the dry wash.			
84. Minimize soil exposure and compaction to protect ground vegetation and the duff layer.			
85. Avoid cabling logs across the dry wash, where feasible, to prevent damage to the banks of the dry wash.			
General BMPs for Stream Crossings on Skid Trails (p. 67-68)			
D-c. Are there any stream crossings associated with the skid trails?	❑ Yes. Go to next question.		❑ No. Go to Section E – Wetlands.
D-d. Which of the following best describe the stream crossing?	❑ New crossing used. Go to next question. ❑ Existing stream crossing used. Go to Question 92. ❑ Both new and existing stream crossings used. Go to next question.		
86. Identify optimum stream crossing locations: straight and narrow stream channels; low banks; firm rocky soil; keep approaches at the least gradient possible.			
87. Install stream crossing structures at right angles to the stream channel.			
88. Install stream crossings using materials that are clean, non-erodible and non-toxic to aquatic life.			
89. Minimize channel changes and the amount of excavation or fill needed at the crossing.			
90. Limit construction activity in the streambed to periods of low or normal flow. Keep use of equipment in the stream to a minimum.			
91. Use soil stabilization practices on exposed soil at stream crossings.			

92. Design, construct and maintain stream crossings to avoid disrupting the migration/movement of fish and other aquatic life.			
93. Use diversion ditches, broad-based dips, or other practices on the road approaches to prevent road runoff from entering the stream.			
94. Stabilize approaches to crossings with aggregate or other suitable material to reduce sediment entering the stream.			
D-e. What type of stream crossings were used on the skid trails?	❑ Bridges ❑ Culverts ❑ Fords ❑ Pole fords (PVC or logs) ❑ Timber mats ❑ Frozen snow/ice crossing ❑ Other: _____ ❑ Stream crossed without any structure		
Stream Crossing BMPs for Culverts on Skid Trails (p. 69)			
D-f. Were pipe culverts used for crossing streams on skid trails?	❑ Yes. Go to next question.	❑ No. Go to Question D-h.	
D-g. Which of the following best describe the stream crossing structure(s)?	❑ New culvert(s) were installed. Go to next question. ❑ Existing culvert(s) were used. Go to Question 100. ❑ Both new and existing culvert(s) were used. Go to next question.		
95. Install culverts that extend at least 1 foot beyond the road fill.			
96. Install culverts that are large enough to pass flood flows.			
97. Install culverts so there in no change in the stream bottom elevation. Culverts should not dam or pool water.			
98. Firmly compact material around culverts, particularly the bottom half. To prevent crushing, cover the top of culverts with fill to a depth of 1/3 the culvert diameter or at least 12 inches, whichever is greater.			
99. Use riprap around the inlet and outlet of culverts to prevent water from eroding and undercutting the culvert.			
100. Keep culverts clear and free of debris so that water can pass unimpeded at all times.			
Fords for Stream Crossings on Skid Trails (p. 27 & 40)			
D-h. Were fords used for crossing streams on skid trails?	❑ Yes. Go to next question.	❑ No. Go to Question D-j.	
D-i. Which of the following best describe the stream crossing structure(s)?	❑ New ford(s) were installed. Go to next question. ❑ Existing ford(s) were used. Go to Question D-h. ❑ Both new and existing ford(s) were used. Go to next question.		
101. Locate fords where stream banks are low.			
102. Locate where the stream bed has a firm rock or gravel streambed.			

Temporary Stream Crossing BMPs on Skid Trails (p. 71)			
D-j. Were temporary stream crossing structures installed on skid trails?	❑ Yes. Go to next question.		❑ No. Go to Section E – Wetlands.
103. Use temporary stream crossings such as timber mats, pole fords, or frozen fords when appropriate.			
104. Anchor temporary structures on one end with a cable or other device so they do not float away during high water.			
E. Wetlands			
General Wetland BMPs (p.100)			
E-a. Is there a wetland present?	❑ Yes. Go to next question.		❑ No. Go to Section F – Supplemental Questions.
105. Whenever practical, avoid locating roads and landings in wetlands; otherwise use extreme caution.			
106. Whenever possible, forest management activities in wetlands should occur on frozen ground to minimize rutting.			
107. Do not dispose of or move upland slash into a wetland. Slash from trees harvested within the wetland may remain in the wetland.			
E-b. What best describes the source of slash deposition in the wetland?	❑ Slash was moved into the wetland from the uplands. ❑ Slash was from trees harvested in the wetlands. ❑ No slash was left in the wetland.		
108. Keep slash out of open water.			
109. Whenever practical, avoid equipment maintenance and fueling in wetlands.			
Wetland Filter Strip BMPs (p.101)			
110. Whenever practical, avoid locating roads and landings in the wetland filter strip; otherwise use extreme caution.			
111. Minimize soil exposure and compaction to protect the ground vegetation and the duff layer in the wetland filter strip.			
112. Operate equipment in the wetland filter strip only when the ground is firm or frozen.			
Wetland Roads, Skid Trails, and Landings (pp. 105-108)			
E-c. Were any wetlands crossed to access or to harvest the timber sale or were any wetlands used as landings?	❑ Yes. Go to next question.		❑ No. Go to Section F – Supplemental Questions.
113. Construct upland approaches to the wetland so the surface runoff is diverted away from the road approach prior to reaching the wetland.			
114. If landings are necessary in a wetland, build them to the minimum size required for the operation and to achieve the landowner's objective.			

115. Avoid operating equipment in areas of open water, springs, or seeps.			
116. Provide for adequate cross-road drainage in roads to minimize changes to natural surface and subsurface flow in the wetland.			
117. Use low ground pressure equipment, such as wide tire or tracked equipment, if necessary to minimize rutting.			
118. Minimize rutting in wetlands by conducting forestry activities on firm or frozen ground that can support the equipment.			
119. Cease equipment operations when rutting becomes excessive.			

F. Supplemental Questions

Water Resources		
F-a. Are there any springs or seeps present?	❑ Yes. Go to next question.	❑ No. Go to Question F-d.
F-b. Was there a skid trail or forest road in a spring or seep?	❑ Yes. Go to next question.	❑ No. Go to Question F-d.
F-c. What was the impact on the spring or seep?	❑ No adverse impact to water quality. ❑ Minor short-term impacts to water quality ❑ Minor long-term impacts to water quality. ❑ Major short-term impacts to water quality. ❑ Major long-term impacts to water quality.	
Timber Harvesting		
F-d. What is the dominant cover type(s) of the harvested area? (check all that apply)	❑ Aspen ❑ Spruce/Fir ❑ Pine ❑ Maple/Basswood ❑ Oak/Hickory ❑ Bottomland Hardwoods ❑ Swamp Conifers ❑ Other:	
F-e. If the dominant tree species that were harvested are different than the dominant cover type, what types of tree species were harvested?	❑ Aspen ❑ Spruce/Fir ❑ Pine ❑ Maple/Basswood ❑ Oak/Hickory ❑ Bottomland Hardwoods ❑ Swamp Conifers ❑ Other:	
F-f. What best describes the silvicultural prescription(s) used?	❑ Clearcut ❑ Clearcut with reserves ❑ Shelterwood ❑ Seedtree ❑ Selection harvest ❑ Other:	
F-g. What best describes the timber stand improvements that were used, if any.	❑ Pre-commercial thinning ❑ Crop tree release ❑ Other: ❑ None	
	❑ Shortwood (cut-to-length)	

F-h. What best describes the type of harvesting system(s) used? (check all that apply)	❑ Tree-length (pole skidding) ❑ Whole tree (chipping operation) ❑ Other:	
F-i. What best describes the logging equipment used?	❑ Wheeled ❑ Tracked ❑ Both ❑ Other:	
F-j. Was this a salvage operation?	❑ Yes	❑ No.
F-k. What season(s) did harvesting occur?	❑ Spring (March – May)	
	❑ Summer (June – August)	
	❑ Fall (September – November)	
	❑ Winter (December – February)	
	❑ Unknown	
Overall Evaluation		
F-l. What were some of the positive aspects of this timber sale?		
F-m. With respect to water quality, what could have been done better?		
F-n. How would you rate this site for the overall application of BMPs for water quality?	❑ 1 = Total negligence ❑ 2 = Poor ❑ 3 = Average ❑ 4 = Good ❑ 5 = Excellent	
F-o. How would you rate this site for its overall impact on water quality?	❑ 1 = Severe impacts to water quality ❑ 2 = Moderate impacts to water quality ❑ 3 = Slight impacts to water quality ❑ 4 = Negligible impacts to water quality ❑ 5 = No visible impacts to water quality	

GPS and Photo Waypoint Log

(Important for documenting waypoint data)

Lat/Long/Waypoint Name	Description of Waypoint and Photo	Date and Time

F-p. Was This sale seasonally restricted due to water quality concerns?

- ❑ Yes – All of the sale was completely restricted due to water quality concerns
- ❑ Yes – Some of the sale (____%) was partially restricted due to water quality concerns
- ❑ No – None of the sale was restricted due to water quality concerns

Appendix F-1: County Results

Timber Sales	**Application Rating**	**Effectiveness Rating**					
BMP	BMP Application	Total	No Adverse Impact	Minor Short-Term Impact	Minor Long-Term Impact	Major Short-Term Impact	Major Long-Term Impact
Summary of ALL BMP's	Not Applicable	2602					
	Insufficient Information	0					
	Applied Correctly	1309	1308	1	0	0	0
	Applied Incorrectly	26	3	14	9	0	0
	Not Applied	109	31	17	61	0	0
Fuels, Lubricants, Waste, and Spills							
1. Designate soecific areas for equipment maintenance and fueling. Locate these areas on level terrain, a minimum of 100 feet from all lakes and streams.	Not Applicable	0					
	Insufficient Information	0					
	Applied Correctly	34	34	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
2. Collect all waste lubricants, containers and trash (i.e. grease cartridges).	Not Applicable	0					
	Insufficient Information	0					
	Applied Correctly	33	33	0	0	0	0
	Applied Incorrectly	1	0	0	1	0	0
	Not Applied	0	0	0	0	0	0
Riparian Management Zones							
3. Locate roads outside the RMZ, unless necessary for stream crossings.	Not Applicable	9					
	Insufficient Information	0					
	Applied Correctly	25	25	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
4. Locate landings outside the RMZ.	Not Applicable	9					
	Insufficient Information	0					
	Applied Correctly	25	25	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
5. Do not dispose of or pile slash within the RMZ.	Not Applicable	9					
	Insufficient Information	0					
	Applied Correctly	24	24	0	0	0	0
	Applied Incorrectly	1	0	1	0	0	0
	Not Applied	0	0	0	0	0	0
	Not Applicable	9					
	Insufficient Information	0					

6. Minimize soil exposure and compaction to protect ground vegetation and the duff layer.	Applied Correctly	25	25	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
7. Do not operate wheeled or tracked equipment within 15 feet of the ordinary high water mark (OHWM) except on roads or at stream crossings.	Not Applicable	16					
	Insufficient Information	0					
	Applied Correctly	18	18	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
8. Operate wheeled or tracked equipment within 15 to 50 feet of the OHWM when the ground is frozen or dry.	Not Applicable	16					
	Insufficient Information	0					
	Applied Correctly	18	18	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
9. Do not harvest fine woody material within 50 feet of the OHWM.	Not Applicable	16					
	Insufficient Information	0					
	Applied Correctly	18	18	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
10. Use selection harvests and promote long-lived tree species appropriate to the site.	Not Applicable	17					
	Insufficient Information	0					
	Applied Correctly	16	16	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	1	1	0	0	0	0
11. Harvesting intervals should be a minimum of every 10 years.	Not Applicable	16					
	Insufficient Information	0					
	Applied Correctly	18	18	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
12. Harvesting plans should leave at least 60 ft2 of basal area per acre in trees 5 inches DBH and larger, evenly distributed.	Not Applicable	16					
	Insufficient Information	0					
	Applied Correctly	16	16	0	0	0	0
	Applied Incorrectly	1	0	0	1	0	0
	Not Applied	1	0	0	1	0	0
13. Develop trees 12 inches DBH and larger.	Not Applicable	16					
	Insufficient Information	0					
	Applied Correctly	18	18	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
14. Operate wheeled or tracked harvesting equipment within 15 feet of the ordinary high water mark (OHWM), only when the ground is frozen or dry.	Not Applicable	25					
	Insufficient Information	0					
	Applied Correctly	9	9	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
	Not Applicable	25					

15. Do not harvest fine woody material within 15 feet of the OHWM.	Insufficient Information	0					
	Applied Correctly	9	9	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
16. Use selection harvests and promote long-lived tree species appropriate to the site.	Not Applicable	25					
	Insufficient Information	0					
	Applied Correctly	9	9	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
17. Harvesting intervals should be a minimum of every 10 years.	Not Applicable	25					
	Insufficient Information	0					
	Applied Correctly	9	9	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
18. Harvesting plans should leave at least 60 ft2 of basal area per acre in trees 5 inches DBH and larger, evenly distributed.	Not Applicable	25					
	Insufficient Information	0					
	Applied Correctly	9	9	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
19. Operate wheeled or tracked harvesting equipment within 15 feet of the ordinary high-water mark (OHWM) only when the ground is frozen or dry.	Not Applicable	32					
	Insufficient Information	0					
	Applied Correctly	2	2	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
20. Do not harvest fine woody material within 15 feet of the OHWM.	Not Applicable	32					
	Insufficient Information	0					
	Applied Correctly	2	2	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
Forest Roads							
21. Use existing roads when they provide the best long-term access.	Not Applicable	3					
	Insufficient Information	0					
	Applied Correctly	31	31	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
22. Select road locations that allow for drainage away from the road.	Not Applicable	15					
	Insufficient Information	0					
	Applied Correctly	17	17	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	2	0	0	2	0	0
23. Where possible, locate roads on well-drained soils.	Not Applicable	15					
	Insufficient Information	0					
	Applied Correctly	18	18	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0

	Not Applied	1	0	0	1	0	0
24. Minimize the number of stream, dry wash, and wetland crossings.	Not Applicable	15					
	Insufficient Information	0					
	Applied Correctly	18	18	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	1	0	0	1	0	0
25. Locate roads outside of riparian management zones and wetland filter strips, except at crossings	Not Applicable	15					
	Insufficient Information	0					
	Applied Correctly	19	19	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
26. Road grades should not exceed 10%. If road grades greater than 10% are necessary, limit grade length or break the grade using drainage structures.	Not Applicable	20					
	Insufficient Information	0					
	Applied Correctly	13	13	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	1	1	0	0	0	0
27. Construct roads to follow natural contours and minimize cut and fills.	Not Applicable	15					
	Insufficient Information	0					
	Applied Correctly	19	19	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
28. Construct roads to remove water from road surfaces.	Not Applicable	15					
	Insufficient Information	0					
	Applied Correctly	15	15	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	4	0	0	4	0	0
29. Construct stable cut and fill slopes that will re-vegetate easily, either naturally or artificially.	Not Applicable	17					
	Insufficient Information	0					
	Applied Correctly	15	15	0	0	0	0
	Applied Incorrectly	1	0	0	1	0	0
	Not Applied	1	1	0	0	0	0
30. Do not bury debris in the road base.	Not Applicable	15					
	Insufficient Information	0					
	Applied Correctly	19	19	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
31. Install drainage structures to remove water from road surface and ditches.	Not Applicable	18					
	Insufficient Information	0					
	Applied Correctly	12	12	0	0	0	0
	Applied Incorrectly	2	0	1	1	0	0
	Not Applied	2	0	0	2	0	0
32. Install a berm at the inlets of drainage structures, if needed, to direct water into the structures.	Not Applicable	29					
	Insufficient Information	0					
	Applied Correctly	5	5	0	0	0	0

	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
33. Provide erosion protection at the outlets of drainage structures to minimize erosion and disperse the water.	Not Applicable	28					
	Insufficient Information	0					
	Applied Correctly	5	5	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	1	1	0	0	0	0
34. Install drainage structures at grades of at least 2% more than the ditch grade and at a 30 to 45 degree angle to the road.	Not Applicable	27					
	Insufficient Information	0					
	Applied Correctly	5	5	0	0	0	0
	Applied Incorrectly	1	0	1	0	0	0
	Not Applied	1	1	0	0	0	0
35. Check drainage structures to ensure that they are not filling with sediment or other debris. Clean if needed.	Not Applicable	18					
	Insufficient Information	0					
	Applied Correctly	10	10	0	0	0	0
	Applied Incorrectly	1	0	1	0	0	0
	Not Applied	5	3	0	2	0	0
36. Install cross drain culverts long enough to extend beyond the road fill.	Not Applicable	22					
	Insufficient Information	0					
	Applied Correctly	7	7	0	0	0	0
	Applied Incorrectly	1	0	1	0	0	0
	Not Applied	4	2	0	2	0	0
37. Construct broad-based dips deep enough to provide adequate drainage and wide enough to allow trucks and equipment to pass safely.	Not Applicable	33					
	Insufficient Information	0					
	Applied Correctly	1	1	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
38. Use seed, mulch and/or erosion control netting where necessary to minimize soil erosion into lakes, streams and wetlands.	Not Applicable	26					
	Insufficient Information	0					
	Applied Correctly	8	8	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
39. Install sediment control structures where necessary to slow the flow of runoff and trap sediment until vegetation is established at the sediment source.	Not Applicable	30					
	Insufficient Information	0					
	Applied Correctly	3	3	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	1	1	0	0	0	0
40. Maintain, clean and/or replace sediment control structures until areas of exposed soil are stabilized.	Not Applicable	31					
	Insufficient Information	0					
	Applied Correctly	3	3	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
41. Inspect the road system at regular intervals. Clear debris	Not Applicable	14					
	Insufficient Information	0					

from drainage structures to prevent clogging that can lead to washouts.	Applied Correctly	12	12	0	0	0	0
	Applied Incorrectly	1	1	0	0	0	0
	Not Applied	7	1	2	4	0	0
42. Keep traffic to a minimum during wet periods and spring break-up to reduce maintenance needs.	Not Applicable	10					
	Insufficient Information	0					
	Applied Correctly	10	10	0	0	0	0
	Applied Incorrectly	1	0	1	0	0	0
	Not Applied	13	9	1	3	0	0
43. Shape road surfaces periodically to maintain proper surface drainage. Fill in ruts and holes with gravel or compacted fill as soon as possible to reduce erosion potential.	Not Applicable	10					
	Insufficient Information	0					
	Applied Correctly	15	15	0	0	0	0
	Applied Incorrectly	1	0	0	1	0	0
	Not Applied	8	1	3	4	0	0
44. Remove berms along the edge of the road if they will trap water on the road.	Not Applicable	27					
	Insufficient Information	0					
	Applied Correctly	6	5	1	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	1	0	1	0	0	0
45. When dust control agents are used, apply them in a manner that will keep these compounds from entering lakes, stream and groundwater.	Not Applicable	34					
	Insufficient Information	0					
	Applied Correctly	0	0	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
46. Remove all temporary drainage and crossing structures.	Not Applicable	31					
	Insufficient Information	0					
	Applied Correctly	3	3	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
47. Shape all road system surfaces to maintain proper surface drainage, if necessary.	Not Applicable	24					
	Insufficient Information	0					
	Applied Correctly	8	8	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	2	0	1	1	0	0
48. Inspect and maintain road surfaces, drainage structures, and crossings to minimize erosion.	Not Applicable	23					
	Insufficient Information	0					
	Applied Correctly	10	10	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	1	1	0	0	0	0
49. Identify optimum stream crossing locations: straight and narrow stream channels; low banks; firm rocky soil; keep approaches at the least gradient possible.	Not Applicable	33					
	Insufficient Information	0					
	Applied Correctly	1	1	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
	Not Applicable	33					

50. Install stream crossing structures at right angles to the stream channel.	Insufficient Information	0					
	Applied Correctly	0	0	0	0	0	0
	Applied Incorrectly	1	0	0	1	0	0
	Not Applied	0	0	0	0	0	0
51. Install stream crossings using materials that are clean, non-erodible and non-toxic to aquatic life.	Not Applicable	33					
	Insufficient Information	0					
	Applied Correctly	1	1	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
52. Minimize channel changes and the amount of excavation or fill needed at the crossing.	Not Applicable	33					
	Insufficient Information	0					
	Applied Correctly	1	1	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
53. Limit construction activity in the streambed to periods of low or normal flow. Keep use of equipment in the stream to a minimum.	Not Applicable	33					
	Insufficient Information	0					
	Applied Correctly	1	1	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
54. Use soil stabilization practices on exposed soil at stream crossings.	Not Applicable	33					
	Insufficient Information	0					
	Applied Correctly	0	0	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	1	1	0	0	0	0
55. Design, construct and maintain stream crossings to avoid disrupting the migration/movement of fish and other aquatic life.	Not Applicable	27					
	Insufficient Information	0					
	Applied Correctly	6	6	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	1	0	0	1	0	0
56. Use diversion ditches, broad-based dips, or other practices on the road approaches to prevent road runoff from entering the stream.	Not Applicable	31					
	Insufficient Information	0					
	Applied Correctly	0	0	0	0	0	0
	Applied Incorrectly	1	0	1	0	0	0
	Not Applied	2	1	0	1	0	0
57. Stabilize approaches to crossings with aggregate or other suitable material to reduce sediment entering the stream.	Not Applicable	28					
	Insufficient Information	0					
	Applied Correctly	6	6	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
58. Install culverts that extend at least 1 foot beyond the road fill.	Not Applicable	31					
	Insufficient Information	0					
	Applied Correctly	3	3	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0

59. Install culverts that are large enough to pass flood flows.	Not Applicable	31					
	Insufficient Information	0					
	Applied Correctly	2	2	0	0	0	0
	Applied Incorrectly	1	0	0	1	0	0
	Not Applied	0	0	0	0	0	0
60. Install culverts so there in no change in the stream bottom elevation. Culverts should not dam or pool water.	Not Applicable	31					
	Insufficient Information	0					
	Applied Correctly	3	3	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
61. Firmly compact material around culverts, particularly the bottom half. To prevent crushing, cover the top of culverts with fill to a depth of 1/3 the culvert diameter or at least 12 inches, whichever is greater.	Not Applicable	31					
	Insufficient Information	0					
	Applied Correctly	3	3	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
62. Use riprap around the inlet and outlet of culverts to prevent water from eroding and undercutting the culvert.	Not Applicable	31					
	Insufficient Information	0					
	Applied Correctly	2	2	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	1	0	0	1	0	0
63. Keep culverts clear and free of debris so that water can pass unimpeded at all times.	Not Applicable	28					
	Insufficient Information	0					
	Applied Correctly	4	4	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	2	0	0	2	0	0
64. Locate fords where stream banks are low.	Not Applicable	34					
	Insufficient Information	0					
	Applied Correctly	0	0	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
65. Locate where the stream bed has a firm rock or gravel streambed.	Not Applicable	34					
	Insufficient Information	0					
	Applied Correctly	0	0	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
66. Use temporary stream crossings such as timber mats, pole fords, or frozen fords when appropriate.	Not Applicable	34					
	Insufficient Information	0					
	Applied Correctly	0	0	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
67. Anchor temporary structures on one end with a cable or other device so they do not float away during high water.	Not Applicable	34					
	Insufficient Information	0					
	Applied Correctly	0	0	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0

	Not Applied	0	0	0	0	0	0
Timber Harvesting							
68. Use existing landings if possible.	Not Applicable	14					
	Insufficient Information	0					
	Applied Correctly	20	20	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
69. Locate landings on frozen ground or on firm well-drained soils with a slight slope or that have been shaped to promote efficient drainage.	Not Applicable	0					
	Insufficient Information	0					
	Applied Correctly	33	33	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	1	0	0	1	0	0
70. Locate residue piles (sawdust, chipping residue, and other material) away from areas where runoff may wash residue into streams, lakes or wetlands.	Not Applicable	5					
	Insufficient Information	0					
	Applied Correctly	29	29	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
71. Where possible, keep skid trail grades less than 15%. Where steep grades are unavoidable, break the grade and install drainage structures at recommended intervals. Grades greater than 15% should not exceed 300 feet in length.	Not Applicable	7					
	Insufficient Information	0					
	Applied Correctly	26	26	0	0	0	0
	Applied Incorrectly	1	0	1	0	0	0
	Not Applied	0	0	0	0	0	0
72. Use existing skid trails if they provide the best long-term access.	Not Applicable	13					
	Insufficient Information	0					
	Applied Correctly	20	20	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	1	0	0	1	0	0
73. Limit the length and number of skid trails, landing, and stream crossing to the minimum necessary for conducting the harvest operation and to meet the landowner's objectives.	Not Applicable	0					
	Insufficient Information	0					
	Applied Correctly	34	34	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
74. Whenever possible, winch logs up steep slopes if conventional skidding could cause erosion that affects water quality.	Not Applicable	30					
	Insufficient Information	0					
	Applied Correctly	4	4	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
75. Avoid operating equipment where excessive soil compaction, rutting, or channelized runoff may cause erosion that affects water quality.	Not Applicable	0					
	Insufficient Information	0					
	Applied Correctly	29	29	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	5	0	1	4	0	0
76. Fill in ruts, apply seed and mulch, and install sediment control structures and drainage	Not Applicable	14					
	Insufficient Information	0					

structures on skid trails and landings where needed to prevent erosion and sedimentation into surface waters.	Applied Correctly	14	14	0	0	0	0
	Applied Incorrectly	2	0	2	0	0	0
	Not Applied	4	0	1	3	0	0
77. Inspect soil stabilization practices periodically during and after harvest operations to insure that they are successful and remain functional.	Not Applicable	24					
	Insufficient Information	0					
	Applied Correctly	9	9	0	0	0	0
	Applied Incorrectly	1	0	1	0	0	0
	Not Applied	0	0	0	0	0	0
78. Do not dispose of or pile slash in areas where runoff may wash slash into lakes, streams, or wetlands.	Not Applicable	3					
	Insufficient Information	0					
	Applied Correctly	31	31	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
79. For winter harvesting, mark stream channels, dry washes, and existing culvert locations before snowfall.	Not Applicable	20					
	Insufficient Information	0					
	Applied Correctly	9	9	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	5	3	0	2	0	0
80. Use selection harvests or patch clear-cuts within 35 feet of the dry wash to promote tree species appropriate to the site.	Not Applicable	34					
	Insufficient Information	0					
	Applied Correctly	0	0	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
81. Avoid locating roads and landings within 35 feet of the dry wash unless necessary for crossings.	Not Applicable	34					
	Insufficient Information	0					
	Applied Correctly	0	0	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
82. Operate wheeled or tracked equipment within 15 feet of the dry wash only when the ground is frozen or dry.	Not Applicable	34					
	Insufficient Information	0					
	Applied Correctly	0	0	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
83. Do not harvest fine woody material within 15 feet of the dry wash.	Not Applicable	34					
	Insufficient Information	0					
	Applied Correctly	0	0	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
84. Minimize soil exposure and compaction to protect ground vegetation and the duff layer.	Not Applicable	34					
	Insufficient Information	0					
	Applied Correctly	0	0	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
	Not Applicable	34					

85. Avoid cabling logs across the dry wash, where feasible, to prevent damage to the banks of the dry wash.	Insufficient Information	0					
	Applied Correctly	0	0	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
86. Identify optimum stream crossing locations: straight and narrow stream channels; low banks; firm rocky soil; keep approaches at the least gradient possible.	Not Applicable	32					
	Insufficient Information	0					
	Applied Correctly	2	2	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
87. Install stream crossing structures at right angles to the stream channel.	Not Applicable	32					
	Insufficient Information	0					
	Applied Correctly	2	2	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
88. Install stream crossings using materials that are clean, non-erodible and non-toxic to aquatic life.	Not Applicable	33					
	Insufficient Information	0					
	Applied Correctly	1	1	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
89. Minimize channel changes and the amount of excavation or fill needed at the crossing.	Not Applicable	32					
	Insufficient Information	0					
	Applied Correctly	2	2	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
90. Limit construction activity in the streambed to periods of low or normal flow. Keep use of equipment in the stream to a minimum.	Not Applicable	33					
	Insufficient Information	0					
	Applied Correctly	1	1	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
91. Use soil stabilization practices on exposed soil at stream crossings.	Not Applicable	33					
	Insufficient Information	0					
	Applied Correctly	1	1	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
92. Design, construct and maintain stream crossings to avoid disrupting the migration/movement of fish and other aquatic life.	Not Applicable	30					
	Insufficient Information	0					
	Applied Correctly	4	4	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
93. Use diversion ditches, broad-based dips, or other practices on the road approaches to prevent road runoff from entering the stream.	Not Applicable	33					
	Insufficient Information	0					
	Applied Correctly	1	1	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0

94. Stabilize approaches to crossings with aggregate or other suitable material to reduce sediment entering the stream.	Not Applicable	32					
	Insufficient Information	0					
	Applied Correctly	2	2	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
95. Install culverts that extend at least 1 foot beyond the road fill.	Not Applicable	34					
	Insufficient Information	0					
	Applied Correctly	0	0	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
96. Install culverts that are large enough to pass flood flows.	Not Applicable	34					
	Insufficient Information	0					
	Applied Correctly	0	0	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
97. Install culverts so there in no change in the stream bottom elevation. Culverts should not dam or pool water.	Not Applicable	34					
	Insufficient Information	0					
	Applied Correctly	0	0	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
98. Firmly compact material around culverts, particularly the bottom half. To prevent crushing, cover the top of culverts with fill to a depth of 1/3 the culvert diameter or at least 12 inches, whichever is greater.	Not Applicable	34					
	Insufficient Information	0					
	Applied Correctly	0	0	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
99. Use riprap around the inlet and outlet of culverts to prevent water from eroding and undercutting the culvert.	Not Applicable	34					
	Insufficient Information	0					
	Applied Correctly	0	0	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
100. Keep culverts clear and free of debris so that water can pass unimpeded at all times.	Not Applicable	34					
	Insufficient Information	0					
	Applied Correctly	0	0	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
101. Locate fords where stream banks are low.	Not Applicable	34					
	Insufficient Information	0					
	Applied Correctly	0	0	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
102. Locate where the stream bed has a firm rock or gravel streambed.	Not Applicable	34					
	Insufficient Information	0					
	Applied Correctly	0	0	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0

	Not Applied	0	0	0	0	0	0
103. Use temporary stream crossings such as timber mats, pole fords, or frozen fords when appropriate.	Not Applicable	31					
	Insufficient Information	0					
	Applied Correctly	3	3	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
104. Anchor temporary structures on one end with a cable or other device so they do not float away during high water.	Not Applicable	33					
	Insufficient Information	0					
	Applied Correctly	1	1	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
Wetlands							
105. Whenever practical, avoid locating roads and landings in wetlands; otherwise use extreme caution.	Not Applicable	0					
	Insufficient Information	0					
	Applied Correctly	33	33	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	1	0	0	1	0	0
106. Whenever possible, forest management activities in wetlands should occur on frozen ground to minimize rutting.	Not Applicable	4					
	Insufficient Information	0					
	Applied Correctly	25	25	0	0	0	0
	Applied Incorrectly	1	1	0	0	0	0
	Not Applied	4	1	1	2	0	0
107. Do not dispose of or move upland slash into a wetland. Slash from trees harvested within the wetland may remain in the wetland.	Not Applicable	1					
	Insufficient Information	0					
	Applied Correctly	31	31	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	2	0	0	2	0	0
108. Keep slash out of open water.	Not Applicable	3					
	Insufficient Information	0					
	Applied Correctly	29	29	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	2	1	1	0	0	0
109. Whenever practical, avoid equipment maintenance and fueling in wetlands.	Not Applicable	1					
	Insufficient Information	0					
	Applied Correctly	33	33	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
110. Whenever practical, avoid locating roads and landings in the wetland filter strip; otherwise use extreme caution.	Not Applicable	4					
	Insufficient Information	0					
	Applied Correctly	29	29	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	1	0	0	1	0	0
111. Minimize soil exposure and compaction to protect the	Not Applicable	4					
	Insufficient Information	0					

ground vegetation and the duff layer in the wetland filter strip.	Applied Correctly	29	29	0	0	0	0
	Applied Incorrectly	1	0	0	1	0	0
	Not Applied	0	0	0	0	0	0
112. Operate equipment in the wetland filter strip only when the ground is firm or frozen.	Not Applicable	4					
	Insufficient Information	0					
	Applied Correctly	25	25	0	0	0	0
	Applied Incorrectly	1	0	0	1	0	0
	Not Applied	4	0	2	2	0	0
113. Construct upland approaches to the wetland so the surface runoff is diverted away from the road approach prior to reaching the wetland.	Not Applicable	13					
	Insufficient Information	0					
	Applied Correctly	20	20	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	1	0	0	1	0	0
114. If landings are necessary in a wetland, build them to the minimum size required for the operation and to achieve the landowner's objective.	Not Applicable	31					
	Insufficient Information	0					
	Applied Correctly	3	3	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
115. Avoid operating equipment in areas of open water, springs, or seeps.	Not Applicable	15					
	Insufficient Information	0					
	Applied Correctly	18	18	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	1	1	0	0	0	0
116. Provide for adequate cross-road drainage in roads to minimize changes to natural surface and subsurface flow in the wetland.	Not Applicable	15					
	Insufficient Information	0					
	Applied Correctly	14	14	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	5	1	1	3	0	0
117. Use low ground pressure equipment, such as wide tire or tracked equipment, if necessary to minimize rutting.	Not Applicable	10					
	Insufficient Information	0					
	Applied Correctly	22	22	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	2	0	1	1	0	0
118. Minimize rutting in wetlands by conducting forestry activities on firm or frozen ground that can support the equipment.	Not Applicable	8					
	Insufficient Information	0					
	Applied Correctly	20	20	0	0	0	0
	Applied Incorrectly	2	0	1	1	0	0
	Not Applied	4	0	1	3	0	0
119. Cease equipment operations when rutting becomes excessive.	Not Applicable	9					
	Insufficient Information	0					
	Applied Correctly	23	23	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	2	0	0	2	0	0

Appendix F-2: State Results

Timber Sales	**Application Rating**	**Effectiveness Rating**					
BMP	BMP Application	Total	No Adverse Impact	Minor Short-Term Impact	Minor Long-Term Impact	Major Short-Term Impact	Major Long-Term Impact
Summary of ALL BMP's	Not Applicable	2958					
	Insufficient Information	25					
	Applied Correctly	1496	1490	3	3	0	0
	Applied Incorrectly	7	4	1	2	0	0
	Not Applied	36	11	9	15	0	1
Fuels, Lubricants, Waste, and Spills							
1. Designate specific areas for equipment maintenance and fueling. Locate these areas on level terrain, a minimum of 100 feet from all lakes and streams.	Not Applicable	1					
	Insufficient Information	0					
	Applied Correctly	37	37	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
2. Collect all waste lubricants, containers and trash (i.e. grease cartridges).	Not Applicable	1					
	Insufficient Information	0					
	Applied Correctly	37	37	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
Riparian Management Zones							
3. Locate roads outside the RMZ, unless necessary for stream crossings.	Not Applicable	6					
	Insufficient Information	0					
	Applied Correctly	32	32	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
4. Locate landings outside the RMZ.	Not Applicable	5					
	Insufficient Information	0					
	Applied Correctly	33	33	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
5. Do not dispose of or pile slash within the RMZ.	Not Applicable	5					
	Insufficient Information	0					
	Applied Correctly	32	32	0	0	0	0
	Applied Incorrectly	1	1	0	0	0	0
	Not Applied	0	0	0	0	0	0
	Not Applicable	5					
	Insufficient Information	0					

6. Minimize soil exposure and compaction to protect ground vegetation and the duff layer.	Applied Correctly	33	33	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
7. Do not operate wheeled or tracked equipment within 15 feet of the ordinary high water mark (OHWM) except on roads or at stream crossings.	Not Applicable	7					
	Insufficient Information	0					
	Applied Correctly	30	30	0	0	0	0
	Applied Incorrectly	1	1	0	0	0	0
	Not Applied	0	0	0	0	0	0
8. Operate wheeled or tracked equipment within 15 to 50 feet of the OHWM when the ground is frozen or dry.	Not Applicable	8					
	Insufficient Information	0					
	Applied Correctly	30	30	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
9. Do not harvest fine woody material within 50 feet of the OHWM.	Not Applicable	9					
	Insufficient Information	0					
	Applied Correctly	29	29	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
10. Use selection harvests and promote long-lived tree species appropriate to the site.	Not Applicable	13					
	Insufficient Information	0					
	Applied Correctly	25	25	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
11. Harvesting intervals should be a minimum of every 10 years.	Not Applicable	10					
	Insufficient Information	0					
	Applied Correctly	28	28	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
12. Harvesting plans should leave at least 60 ft2 of basal area per acre in trees 5 inches DBH and larger, evenly distributed.	Not Applicable	10					
	Insufficient Information	0					
	Applied Correctly	26	26	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	2	2	0	0	0	0
13. Develop trees 12 inches DBH and larger.	Not Applicable	10					
	Insufficient Information	0					
	Applied Correctly	28	28	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
14. Operate wheeled or tracked harvesting equipment within 15 feet of the ordinary high water mark (OHWM), only when the ground is frozen or dry.	Not Applicable	34					
	Insufficient Information	0					
	Applied Correctly	4	4	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
	Not Applicable	35					

15. Do not harvest fine woody material within 15 feet of the OHWM.	Insufficient Information	0					
	Applied Correctly	3	3	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
16. Use selection harvests and promote long-lived tree species appropriate to the site.	Not Applicable	34					
	Insufficient Information	0					
	Applied Correctly	4	4	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
17. Harvesting intervals should be a minimum of every 10 years.	Not Applicable	33					
	Insufficient Information	0					
	Applied Correctly	5	5	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
18. Harvesting plans should leave at least 60 ft2 of basal area per acre in trees 5 inches DBH and larger, evenly distributed.	Not Applicable	34					
	Insufficient Information	0					
	Applied Correctly	4	4	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
19. Operate wheeled or tracked harvesting equipment within 15 feet of the ordinary high-water mark (OHWM) only when the ground is frozen or dry.	Not Applicable	38					
	Insufficient Information	0					
	Applied Correctly	0	0	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
20. Do not harvest fine woody material within 15 feet of the OHWM.	Not Applicable	38					
	Insufficient Information	0					
	Applied Correctly	0	0	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
Forest Roads							
21. Use existing roads when they provide the best long-term access.	Not Applicable	5					
	Insufficient Information	0					
	Applied Correctly	33	33	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
22. Select road locations that allow for drainage away from the road.	Not Applicable	21					
	Insufficient Information	0					
	Applied Correctly	17	17	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
23. Where possible, locate roads on well-drained soils.	Not Applicable	19					
	Insufficient Information	0					
	Applied Correctly	18	18	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0

	Not Applied	1	1	0	0	0	0
24. Minimize the number of stream, dry wash, and wetland crossings.	Not Applicable	22					
	Insufficient Information	0					
	Applied Correctly	16	16	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
25. Locate roads outside of riparian management zones and wetland filter strips, except at crossings	Not Applicable	20					
	Insufficient Information	0					
	Applied Correctly	18	18	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
26. Road grades should not exceed 10%. If road grades greater than 10% are necessary, limit grade length or break the grade using drainage structures.	Not Applicable	26					
	Insufficient Information	0					
	Applied Correctly	12	12	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
27. Construct roads to follow natural contours and minimize cut and fills.	Not Applicable	21					
	Insufficient Information	0					
	Applied Correctly	17	17	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
28. Construct roads to remove water from road surfaces.	Not Applicable	21					
	Insufficient Information	0					
	Applied Correctly	15	15	0	0	0	0
	Applied Incorrectly	1	1	0	0	0	0
	Not Applied	1	0	0	1	0	0
29. Construct stable cut and fill slopes that will re-vegetate easily, either naturally or artificially.	Not Applicable	30					
	Insufficient Information	0					
	Applied Correctly	8	8	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
30. Do not bury debris in the road base.	Not Applicable	21					
	Insufficient Information	1					
	Applied Correctly	16	16	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
31. Install drainage structures to remove water from road surface and ditches.	Not Applicable	30					
	Insufficient Information	0					
	Applied Correctly	8	8	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
32. Install a berm at the inlets of drainage structures, if needed, to direct water into the structures.	Not Applicable	35					
	Insufficient Information	0					
	Applied Correctly	3	3	0	0	0	0

	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
33. Provide erosion protection at the outlets of drainage structures to minimize erosion and disperse the water.	Not Applicable	34					
	Insufficient Information	0					
	Applied Correctly	4	4	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
34. Install drainage structures at grades of at least 2% more than the ditch grade and at a 30 to 45 degree angle to the road.	Not Applicable	33					
	Insufficient Information	0					
	Applied Correctly	4	4	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	1	0	0	1	0	0
35. Check drainage structures to ensure that they are not filling with sediment or other debris. Clean if needed.	Not Applicable	30					
	Insufficient Information	0					
	Applied Correctly	7	7	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	1	0	0	1	0	0
36. Install cross drain culverts long enough to extend beyond the road fill.	Not Applicable	33					
	Insufficient Information	0					
	Applied Correctly	5	5	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
37. Construct broad-based dips deep enough to provide adequate drainage and wide enough to allow trucks and equipment to pass safely.	Not Applicable	37					
	Insufficient Information	0					
	Applied Correctly	0	0	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	1	0	0	1	0	0
38. Use seed, mulch and/or erosion control netting where necessary to minimize soil erosion into lakes, streams and wetlands.	Not Applicable	29					
	Insufficient Information	0					
	Applied Correctly	9	9	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
39. Install sediment control structures where necessary to slow the flow of runoff and trap sediment until vegetation is established at the sediment source.	Not Applicable	34					
	Insufficient Information	0					
	Applied Correctly	4	4	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
40. Maintain, clean and/or replace sediment control structures until areas of exposed soil are stabilized.	Not Applicable	33					
	Insufficient Information	0					
	Applied Correctly	5	5	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
41. Inspect the road system at regular intervals. Clear debris	Not Applicable	20					
	Insufficient Information	3					

from drainage structures to prevent clogging that can lead to washouts.	Applied Correctly	14	14	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	1	0	0	1	0	0
42. Keep traffic to a minimum during wet periods and spring break-up to reduce maintenance needs.	Not Applicable	15					
	Insufficient Information	2					
	Applied Correctly	19	19	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	2	1	1	0	0	0
43. Shape road surfaces periodically to maintain proper surface drainage. Fill in ruts and holes with gravel or compacted fill as soon as possible to reduce erosion potential.	Not Applicable	17					
	Insufficient Information	2					
	Applied Correctly	14	14	0	0	0	0
	Applied Incorrectly	1	1	0	0	0	0
	Not Applied	4	1	1	2	0	0
44. Remove berms along the edge of the road if they will trap water on the road.	Not Applicable	23					
	Insufficient Information	2					
	Applied Correctly	13	13	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
45. When dust control agents are used, apply them in a manner that will keep these compounds from entering lakes, stream and groundwater.	Not Applicable	34					
	Insufficient Information	2					
	Applied Correctly	2	2	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
46. Remove all temporary drainage and crossing structures.	Not Applicable	27					
	Insufficient Information	1					
	Applied Correctly	10	10	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
47. Shape all road system surfaces to maintain proper surface drainage, if necessary.	Not Applicable	20					
	Insufficient Information	0					
	Applied Correctly	13	13	0	0	0	0
	Applied Incorrectly	2	0	1	1	0	0
	Not Applied	3	0	1	2	0	0
48. Inspect and maintain road surfaces, drainage structures, and crossings to minimize erosion.	Not Applicable	21					
	Insufficient Information	1					
	Applied Correctly	13	13	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	3	0	0	3	0	0
49. Identify optimum stream crossing locations: straight and narrow stream channels; low banks; firm rocky soil; keep approaches at the least gradient possible.	Not Applicable	35					
	Insufficient Information	0					
	Applied Correctly	3	3	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
	Not Applicable	35					

50. Install stream crossing structures at right angles to the stream channel.	Insufficient Information	0					
	Applied Correctly	3	3	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
51. Install stream crossings using materials that are clean, non-erodible and non-toxic to aquatic life.	Not Applicable	35					
	Insufficient Information	0					
	Applied Correctly	3	3	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
52. Minimize channel changes and the amount of excavation or fill needed at the crossing.	Not Applicable	35					
	Insufficient Information	0					
	Applied Correctly	3	3	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
53. Limit construction activity in the streambed to periods of low or normal flow. Keep use of equipment in the stream to a minimum.	Not Applicable	35					
	Insufficient Information	0					
	Applied Correctly	3	3	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
54. Use soil stabilization practices on exposed soil at stream crossings.	Not Applicable	36					
	Insufficient Information	0					
	Applied Correctly	1	1	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	1	0	0	0	0	1
55. Design, construct and maintain stream crossings to avoid disrupting the migration/movement of fish and other aquatic life.	Not Applicable	35					
	Insufficient Information	0					
	Applied Correctly	3	3	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
56. Use diversion ditches, broad-based dips, or other practices on the road approaches to prevent road runoff from entering the stream.	Not Applicable	36					
	Insufficient Information	0					
	Applied Correctly	2	2	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
57. Stabilize approaches to crossings with aggregate or other suitable material to reduce sediment entering the stream.	Not Applicable	35					
	Insufficient Information	0					
	Applied Correctly	3	3	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
58. Install culverts that extend at least 1 foot beyond the road fill.	Not Applicable	37					
	Insufficient Information	0					
	Applied Correctly	1	1	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0

59. Install culverts that are large enough to pass flood flows.	Not Applicable	37					
	Insufficient Information	0					
	Applied Correctly	1	1	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
60. Install culverts so there in no change in the stream bottom elevation. Culverts should not dam or pool water.	Not Applicable	37					
	Insufficient Information	0					
	Applied Correctly	1	1	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
61. Firmly compact material around culverts, particularly the bottom half. To prevent crushing, cover the top of culverts with fill to a depth of 1/3 the culvert diameter or at least 12 inches, whichever is greater.	Not Applicable	37					
	Insufficient Information	0					
	Applied Correctly	1	1	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
62. Use riprap around the inlet and outlet of culverts to prevent water from eroding and undercutting the culvert.	Not Applicable	37					
	Insufficient Information	0					
	Applied Correctly	1	1	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
63. Keep culverts clear and free of debris so that water can pass unimpeded at all times.	Not Applicable	36					
	Insufficient Information	0					
	Applied Correctly	1	1	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	1	1	0	0	0	0
64. Locate fords where stream banks are low.	Not Applicable	37					
	Insufficient Information	0					
	Applied Correctly	1	1	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
65. Locate where the stream bed has a firm rock or gravel streambed.	Not Applicable	37					
	Insufficient Information	0					
	Applied Correctly	1	1	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
66. Use temporary stream crossings such as timber mats, pole fords, or frozen fords when appropriate.	Not Applicable	36					
	Insufficient Information	0					
	Applied Correctly	2	2	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
67. Anchor temporary structures on one end with a cable or other device so they do not float away during high water.	Not Applicable	36					
	Insufficient Information	0					
	Applied Correctly	2	2	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0

	Not Applied	0	0	0	0	0	0
Timber Harvesting							
68. Use existing landings if possible.	Not Applicable	6					
	Insufficient Information	0					
	Applied Correctly	32	32	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
69. Locate landings on frozen ground or on firm well-drained soils with a slight slope or that have been shaped to promote efficient drainage.	Not Applicable	0					
	Insufficient Information	0					
	Applied Correctly	38	38	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
70. Locate residue piles (sawdust, chipping residue, and other material) away from areas where runoff may wash residue into streams, lakes or wetlands.	Not Applicable	5					
	Insufficient Information	0					
	Applied Correctly	33	33	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
71. Where possible, keep skid trail grades less than 15%. Where steep grades are unavoidable, break the grade and install drainage structures at recommended intervals. Grades greater than 15% should not exceed 300 feet in length.	Not Applicable	13					
	Insufficient Information	0					
	Applied Correctly	25	25	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
72. Use existing skid trails if they provide the best long-term access.	Not Applicable	15					
	Insufficient Information	0					
	Applied Correctly	23	23	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
73. Limit the length and number of skid trails, landing, and stream crossing to the minimum necessary for conducting the harvest operation and to meet the landowner's objectives.	Not Applicable	2					
	Insufficient Information	0					
	Applied Correctly	35	35	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	1	1	0	0	0	0
74. Whenever possible, winch logs up steep slopes if conventional skidding could cause erosion that affects water quality.	Not Applicable	32					
	Insufficient Information	1					
	Applied Correctly	5	5	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
75. Avoid operating equipment where excessive soil compaction, rutting, or channelized runoff may cause erosion that affects water quality.	Not Applicable	2					
	Insufficient Information	0					
	Applied Correctly	34	32	2	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	2	0	0	2	0	0
76. Fill in ruts, apply seed and mulch, and install sediment control structures and drainage	Not Applicable	23					
	Insufficient Information	0					

structures on skid trails and landings where needed to prevent erosion and sedimentation into surface waters.	Applied Correctly	14	14	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	1	1	0	0	0	0
77. Inspect soil stabilization practices periodically during and after harvest operations to insure that they are successful and remain functional.	Not Applicable	23					
	Insufficient Information	0					
	Applied Correctly	15	15	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
78. Do not dispose of or pile slash in areas where runoff may wash slash into lakes, streams, or wetlands.	Not Applicable	4					
	Insufficient Information	0					
	Applied Correctly	34	34	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
79. For winter harvesting, mark stream channels, dry washes, and existing culvert locations before snowfall.	Not Applicable	27					
	Insufficient Information	1					
	Applied Correctly	9	9	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	1	1	0	0	0	0
80. Use selection harvests or patch clear-cuts within 35 feet of the dry wash to promote tree species appropriate to the site.	Not Applicable	35					
	Insufficient Information	0					
	Applied Correctly	3	3	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
81. Avoid locating roads and landings within 35 feet of the dry wash unless necessary for crossings.	Not Applicable	35					
	Insufficient Information	0					
	Applied Correctly	3	3	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
82. Operate wheeled or tracked equipment within 15 feet of the dry wash only when the ground is frozen or dry.	Not Applicable	35					
	Insufficient Information	0					
	Applied Correctly	3	3	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
83. Do not harvest fine woody material within 15 feet of the dry wash.	Not Applicable	35					
	Insufficient Information	1					
	Applied Correctly	2	2	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
84. Minimize soil exposure and compaction to protect ground vegetation and the duff layer.	Not Applicable	35					
	Insufficient Information	0					
	Applied Correctly	3	3	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
	Not Applicable	36					

85. Avoid cabling logs across the dry wash, where feasible, to prevent damage to the banks of the dry wash.	Insufficient Information	0					
	Applied Correctly	2	2	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
86. Identify optimum stream crossing locations: straight and narrow stream channels; low banks; firm rocky soil; keep approaches at the least gradient possible.	Not Applicable	31					
	Insufficient Information	1					
	Applied Correctly	6	6	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
87. Install stream crossing structures at right angles to the stream channel.	Not Applicable	31					
	Insufficient Information	1					
	Applied Correctly	6	6	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
88. Install stream crossings using materials that are clean, non-erodible and non-toxic to aquatic life.	Not Applicable	33					
	Insufficient Information	0					
	Applied Correctly	5	5	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
89. Minimize channel changes and the amount of excavation or fill needed at the crossing.	Not Applicable	31					
	Insufficient Information	1					
	Applied Correctly	6	6	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
90. Limit construction activity in the streambed to periods of low or normal flow. Keep use of equipment in the stream to a minimum.	Not Applicable	31					
	Insufficient Information	1					
	Applied Correctly	6	6	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
91. Use soil stabilization practices on exposed soil at stream crossings.	Not Applicable	32					
	Insufficient Information	1					
	Applied Correctly	5	5	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
92. Design, construct and maintain stream crossings to avoid disrupting the migration/movement of fish and other aquatic life.	Not Applicable	33					
	Insufficient Information	0					
	Applied Correctly	5	5	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
93. Use diversion ditches, broad-based dips, or other practices on the road approaches to prevent road runoff from entering the stream.	Not Applicable	38					
	Insufficient Information	0					
	Applied Correctly	0	0	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0

94. Stabilize approaches to crossings with aggregate or other suitable material to reduce sediment entering the stream.	Not Applicable	34					
	Insufficient Information	0					
	Applied Correctly	4	4	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
95. Install culverts that extend at least 1 foot beyond the road fill.	Not Applicable	38					
	Insufficient Information	0					
	Applied Correctly	0	0	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
96. Install culverts that are large enough to pass flood flows.	Not Applicable	38					
	Insufficient Information	0					
	Applied Correctly	0	0	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
97. Install culverts so there in no change in the stream bottom elevation. Culverts should not dam or pool water.	Not Applicable	38					
	Insufficient Information	0					
	Applied Correctly	0	0	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
98. Firmly compact material around culverts, particularly the bottom half. To prevent crushing, cover the top of culverts with fill to a depth of 1/3 the culvert diameter or at least 12 inches, whichever is greater.	Not Applicable	38					
	Insufficient Information	0					
	Applied Correctly	0	0	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
99. Use riprap around the inlet and outlet of culverts to prevent water from eroding and undercutting the culvert.	Not Applicable	38					
	Insufficient Information	0					
	Applied Correctly	0	0	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
100. Keep culverts clear and free of debris so that water can pass unimpeded at all times.	Not Applicable	38					
	Insufficient Information	0					
	Applied Correctly	0	0	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
101. Locate fords where stream banks are low.	Not Applicable	38					
	Insufficient Information	0					
	Applied Correctly	0	0	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
102. Locate where the stream bed has a firm rock or gravel streambed.	Not Applicable	38					
	Insufficient Information	0					
	Applied Correctly	0	0	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0

	Not Applied	0	0	0	0	0	0
103. Use temporary stream crossings such as timber mats, pole fords, or frozen fords when appropriate.	Not Applicable	32					
	Insufficient Information	0					
	Applied Correctly	6	4	1	1	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
104. Anchor temporary structures on one end with a cable or other device so they do not float away during high water.	Not Applicable	36					
	Insufficient Information	1					
	Applied Correctly	1	1	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
Wetlands							
105. Whenever practical, avoid locating roads and landings in wetlands; otherwise use extreme caution.	Not Applicable	2					
	Insufficient Information	0					
	Applied Correctly	35	35	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	1	0	1	0	0	0
106. Whenever possible, forest management activities in wetlands should occur on frozen ground to minimize rutting.	Not Applicable	7					
	Insufficient Information	0					
	Applied Correctly	31	31	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
107. Do not dispose of or move upland slash into a wetland. Slash from trees harvested within the wetland may remain in the wetland.	Not Applicable	1					
	Insufficient Information	0					
	Applied Correctly	34	34	0	0	0	0
	Applied Incorrectly	1	0	1	0	0	0
	Not Applied	2	0	2	0	0	0
108. Keep slash out of open water.	Not Applicable	8					
	Insufficient Information	0					
	Applied Correctly	29	29	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	1	0	1	0	0	0
109. Whenever practical, avoid equipment maintenance and fueling in wetlands.	Not Applicable	3					
	Insufficient Information	1					
	Applied Correctly	34	34	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
110. Whenever practical, avoid locating roads and landings in the wetland filter strip; otherwise use extreme caution.	Not Applicable	6					
	Insufficient Information	0					
	Applied Correctly	31	31	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	1	0	1	0	0	0
111. Minimize soil exposure and compaction to protect the	Not Applicable	6					
	Insufficient Information	0					

ground vegetation and the duff layer in the wetland filter strip.	Applied Correctly	32	32	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
112. Operate equipment in the wetland filter strip only when the ground is firm or frozen.	Not Applicable	8					
	Insufficient Information	0					
	Applied Correctly	30	29	0	1	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
113. Construct upland approaches to the wetland so the surface runoff is diverted away from the road approach prior to reaching the wetland.	Not Applicable	27					
	Insufficient Information	0					
	Applied Correctly	10	10	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	1	1	0	0	0	0
114. If landings are necessary in a wetland, build them to the minimum size required for the operation and to achieve the landowner's objective.	Not Applicable	33					
	Insufficient Information	0					
	Applied Correctly	5	5	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
115. Avoid operating equipment in areas of open water, springs, or seeps.	Not Applicable	20					
	Insufficient Information	0					
	Applied Correctly	18	18	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
116. Provide for adequate cross-road drainage in roads to minimize changes to natural surface and subsurface flow in the wetland.	Not Applicable	24					
	Insufficient Information	0					
	Applied Correctly	13	13	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	1	1	0	0	0	0
117. Use low ground pressure equipment, such as wide tire or tracked equipment, if necessary to minimize rutting.	Not Applicable	17					
	Insufficient Information	0					
	Applied Correctly	21	21	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0
118. Minimize rutting in wetlands by conducting forestry activities on firm or frozen ground that can support the equipment.	Not Applicable	17					
	Insufficient Information	0					
	Applied Correctly	19	18	0	1	0	0
	Applied Incorrectly	1	0	0	1	0	0
	Not Applied	1	0	1	0	0	0
119. Cease equipment operations when rutting becomes excessive.	Not Applicable	20					
	Insufficient Information	0					
	Applied Correctly	18	18	0	0	0	0
	Applied Incorrectly	0	0	0	0	0	0
	Not Applied	0	0	0	0	0	0