July 22, 2013

MEMORANDUM

TO: Forest Practices Board

FROM: Walt Obermeyer, Compliance Monitoring Program Administrator

SUBJECT: Status of Compliance Monitoring

2012 Biennial Report
This report will be provided in the board mailings and discussed at the August 2013 Forest Practices Board meeting.

2013 Field Sampling
The 2013 field season is 70% complete and on schedule to be completed this fall.

WO/

RESOURCES

NATURAL

2012 Interim Forest Practices Compliance Monitoring Report

July 2013

WASHINGTON STATE DEPARTMENT OF
Natural Resources
Peter Goldmark - Commissioner of Public Lands

Acknowledgements

The contributions of the following were critical to the completion of this report:

The tribal, Washington State Departments of Ecology and Fish & Wildlife, and DNR region staff who performed the field reviews in good weather and bad. A special thanks to those that reviewed and entered data, including Jean Parodi, John Heimburg, and Craig Graber,

The Compliance Monitoring Stakeholders Committee, for their thoughtful consideration of the issues. Special thanks to those who provided extensive comments on the draft documents: Mark Hicks, Dick Miller, Steve Barnowe-Meyer, Nancy Sturhan, Marty Acker, Chris Mendoza, Scott Swanson, Nate Putnam, and Doug Hooks,

Kevin Smith, Michelle Peterschick, and Luis Prado for their production and support of graphics,

The Forest Practices Division leadership who patiently reviewed the various drafts.

2012 Interim Forest Practices Compliance Monitoring Report

July 2013

Walt Obermeyer

Charlene Rodgers

Carol Walters

Forest Practices Division

Washington State Department of Natural Resources

Alice Shelly

R2 Resource Consultants, Inc.

Table of Contents

Section	Title
	Executive Summary
1	Introduction
	1.1 History and Context
	1.2 Compliance Monitoring Program
	1.3 Forest Practices Rules
2	Compliance Monitoring Design and Methodology
	2.1 Population and Sample Selection
	2.2 Field Review and Data Collection
	2.3 Compliance Assessment and Ratings
	2.4 Design/Methodology Changes
	2.5 Compliance Monitoring Challenges
3	Forest Practices Rule Compliance for Water Types, and Riparian, Wetland, and Equipment Limitation Zones
	3.1 Statewide Water Type Observations
	3.2 Statewide Summary Table for FP Rule Compliance for RMZs, WMZs and ELZs
	3.3 Western Washington RMZs and ELZs
	3.4 Eastern Washington RMZs and ELZs
	3.5 Statewide WMZs
	3.6 Emphasis Sample
4	Forest Practices Rule Compliance for Roads and Haul Routes
5	Forest Practices Application Compliance
6	Report Discussion
7	Conclusion
8	Recommendations
9	FP Program/FP Rule Changes Based on Compliance Monitoring Feedback
10	Glossary
11	Appendix
12	References

Executive Summary

The Compliance Monitoring Program (CMP) is a key component of the Department of Natural Resources' (DNR) Forest Practices Program (FP program). Compliance monitoring is linked to DNR's responsibility to ensure that operators and landowners are complying with the forest practices rules (FP rules) when conducting forest practices activities. Through monitoring, the CMP provides feedback to the FP program regarding the degree to which specific FP rules are being implemented correctly, and where there is a need for focus, training, or clarity.

The CMP reports on compliance on-the-ground. The FP rules direct DNR to provide "statistically sound, biennial compliance audits and monitoring reports to the (Forest Practices) Board for consideration and support of rule and guidance analysis" (WAC 222-08-160(4)). In addition to the biennial report produced by the CMP, in 2011, the Commissioner of Public Lands requested an annual report in the intervening years. This is the first of the annual reports, containing interim results for the biennial sample and final results for completed emphasis samples.

This first annual CMP report covers data samples collected during the 2012 field season (first year of the biennial cycle). Sample sizes in an annual report are too small to provide robust statistical estimates because observation and data collection is based on a two year model with approximately half the samples observed in the first year and half the samples observed in the second year. Two years are needed to obtain enough samples to attain the desired level of statistical precision. Consequently, with only half of the sample data represented, the findings, conclusions, and recommendations are limited in an annual or interim report. The data from the 2012 and 2013 field seasons will be combined to produce the desired precision for statistical estimates. The resulting comprehensive findings, conclusions, and recommendations will be reported in the 2012/2013 biennial report scheduled for next year. Annual reports provide an interim status of CMP sampling and allow the CMP to convey results from Emphasis Samples that are completed in the first year of the biennial cycle a year earlier than would a biennial report.

The Compliance Monitoring Program evaluates compliance with prioritized FP rules considered to have the greatest impact on the protection of aquatic and riparian species and their habitat. These are riparian and wetland rules, road construction and maintenance rules and haul route rules.

Sample Design and Methodology

The population designated for sampling consists of forest practices applications (FPAs) that have forest practices activities such as timber harvest or road construction that must comply with the specific rules being monitored. FP rules are grouped into categories of similar rules called "prescriptions" for the purposes of monitoring and statistical analysis. Separate samples are chosen for each prescription type being monitored. The list of FPAs that contain the prescriptions being monitored for that year constitutes the pool from which sample selections are drawn for each prescription. For the 2012 report, samples from 116 forest practices applications (FPAs) were chosen from the total population of 2,747 FPAs.

Forest Practices rules monitored annually are referred to as the *Standard* Sample. In addition, certain rule groups are monitored periodically and these are known as an *Emphasis* Sample. The Standard Sample monitors the following rules:

- Riparian protection (WACs 222-30-021 and -022)
- Wetland protection (WAC 222-30-020(7) and WAC 222-24-015)
- Road construction, maintenance, and abandonment (WAC 222-24)
- Haul routes for sediment delivery (WAC 222-24)

In addition, the physical criteria of waters (i.e. stream width, stream gradient, etc.) are observed to estimate the number of occurrences where water types recorded on FPAs are different than what is observed on-the-ground.

For the 2012 field season, the Emphasis Sample was limited to rules pertaining to harvest within riparian management zones (RMZs) for exempt 20-acre parcels (WAC 222-30-023). There are different Forest Practices rules that only apply to the riparian management zones of small forest landowners who own less than 80 acres of forest land in Washington State and are harvesting on a parcel that totals 20 contiguous acres or less. Sampling of RMZ exempt 20-acre parcels was included in the 2008-2009 biennial report, and was an Emphasis Sample in 2012 to help determine if there has been improvement in the compliance rates. The CMP conducted a census on the 2012 population because the total population size was very small.

Changes

The CMP made significant changes in the 2012 sample design to increase confidence in statistical estimates for each prescription type observed. Previously, the Standard Sample design was based on a random selection of FPAs stratified by the proportion of the population found in each DNR region. The sample size for each prescription was dependent on what was observed on the selected FPAs. The 2012 sample design, instead, randomly selects instances of each sampled prescription type occurring in the population. An estimated sample size is calculated for each prescription type which meets a desired confidence interval for a biennium sample. This change in selection design allows for some control in the level of statistical confidence in results and provides a larger information set to help determine causes of non-compliance. It also adds flexibility in the future to add or remove different prescription types from the sample as needed while still providing the desired confidence intervals for each prescription type.

The CMP has also made terminology changes beginning with this report. The terminology used to describe compliance has changed. In past CMP reports, prescriptions have been assessed as either “Compliant” or “Non-compliant”. Starting with the 2012 report, prescriptions are assessed as “Compliant” or a “Deviation”. How the data is calculated has not changed, nor the methodology supporting the collection of the data. How compliance assessment is labeled has been changed to reflect a more accurate description and to acknowledge that while a prescription as a whole may be assessed as a deviation, many of the FP rules that comprise the prescriptions are often compliant.

Notable Aspects of CMP Samples:

- FPAs are randomly selected,

- Conclusions on compliance patterns are based on a two-year monitoring window with approximately half the samples observed in the first year and half the samples observed in the second year. Two years are needed to obtain enough samples to attain the desired level of statistical precision. This report represents only one year of data collection.
- The CMP sets sample sizes based on an estimated 95% confidence interval width of +/- 12% on compliance estimates.
- CMP results are reported separately for small forest landowners and industrial landowners and for all the landowners combined.
- The "Compliant" percentages reported for all sampled prescriptions, except the haul route prescription, reflect the percentage of samples for a certain prescription type where there was compliance with every FP rule within the prescription. See section 2.3 for more information.
- The haul route prescription type follows a different sample design, therefore, compliance percentages reported for the haul route prescription are overall rates of compliance with FP rules for haul routes (instead of percent sample compliant). See section 4 for more information.
- A prescription assessed as compliant is rated as either "compliant" or "exceeds rule requirements" when a landowner implements higher protection standards than required in FP rule.
- When a prescription is assessed as a deviation, it is rated as either "minor, moderate, major, or indeterminate" to provide a sense of the potential impact of the deviation on public resources.
- Compliance is determined for both compliance of the forest practice activity implementation with the FP rules, called "rule compliance" and for compliance of the forest practice activity implementation with what was stated on the FPA, called "FPA compliance".

Compliance Monitoring Challenges

Four challenges faced by the CMP are discussed in the report.

1. Accurately representing the complete picture of compliance has proved difficult. Compliance percentages and ratings don't represent a complete picture of the various levels of compliance. While prescription types have many different FP rules directing them, the program so far has not found a way to quantitatively estimate a compliance percentage for individual prescriptions, therefore, an average compliance rate for a prescription cannot be provided. The compliance rate that is provided is only an estimate of the percent of prescription type samples that are in compliance with all applicable FP rules.

2. Sampling errors occur when the forest practices rule or board manual guidance specifies that *average* values be used during the layout of a particular prescription type. For example, a stream width is determined by averaging measurements along the stream reach. It's unlikely that the compliance monitoring field team will arrive at the same average width without knowing where the landowner's measurements were taken. Statistical analysis techniques, such as a variability study to determine error tolerances, have not yet been pursued by the CMP to determine whether the differences in values are

significant. To acknowledge the inability to determine statistical variability, the CMP currently allows for an absolute 5% measurement error tolerance in two situations, when determining: 1) stream widths (i.e. for a 10-foot-wide stream, the error tolerance would be 6 inches), or 2) buffer widths or floors within no-harvest RMZ areas.

3. Natural systems such as forests are highly variable and difficult to measure with precision. Forest Practices rules require precise measurements to implement forest practices activities. Applying precise measurements becomes difficult for forest practice activity implementation as well as for compliance monitoring. When precise measurements required in the FP rules are confounded by variable site conditions, the CMP follows the most protective interpretation of the FP rules to determine compliance. This happens commonly when an observed stream reach exhibits some physical characteristics of both a Type Np stream and a Type F stream as defined by rule. The compliance monitoring team considers the stream to be Type F water.

4. There are challenges with the existing protocols used to assess compliance with the forest practices rules pertaining to shade requirements. The CMP protocols are not currently designed to determine the adequacy of information submitted with the FPA that document pre-harvest site assessment for shade. Additionally, prior to the most recent version of the FPA (dated July 2012), shade documentation was not required to be submitted. Finally, the CMP does not try to measure shade for compliance after harvest. The program needs to test the FP board manual method using the densiometer to assure repeatable results can be achieved throughout the sampling season.

Findings

Findings from the 2012 sampling season are reported in sections 3 and 4. It is important to remember that compliance monitoring findings only represent one year of the required two years of data needed for precise estimates. Conclusions cannot be made for samples that only have one year of data. The two exceptions in the 2012 samples are the RMZ exempt 20-acre parcel Emphasis Sample and the haul route Standard Sample. The RMZ exempt 20-acre parcel Emphasis Sample was designed as a one year sample and is compared in this report to the RMZ exempt 20-acre parcel Emphasis Sample that was completed in 2008. The 2012 haul route sample is compared statistically to the 2011 haul route sample because the sample size in both years was large enough to provide adequate statistical precision.

Table 5 in section 3.2 provides a summary for FP rule compliance of interim results for individual prescriptions for riparian harvest prescriptions and wetland prescriptions by landowner type (small forest landowners, industrial landowners).

Exempt 20-acre Parcels

Findings from the Emphasis Sample of the exempt 20-acre parcels on the 28 applications reviewed showed 57% of the samples were assessed as compliant.

Haul Routes

The rate of compliance for haul routes in the 2012 assessment was 87%.

Interim Riparian and Wetland Prescriptions
Western Washington interim riparian prescription results appear to show a tendency of improvement for compliance with prescriptions for No Outer Zone Type S and F harvest, and Type N prescriptions. Results on Western Washington prescriptions for No Inner Zone Harvest, and DFC Option 1 and 2 are lower within the sample. All Eastern Washington prescriptions show a tendency of improvement for compliance. Full confidence in the sample results will only be available upon completion of the biennial sample.

Discussion
Two prescription types are discussed: RMZs for 20-acre exempt parcels prescription type (Emphasis Sample) and the haul route prescription type. In addition the discussion (section 6) covers an overview of compliance proportioned across the population and CMP challenges.

RMZ Exempt 20-acre Parcels
FPAs associated with RMZs for exempt 20-acre parcels comprise 2.2% of total FPAs submitted to DNR.

- The low rate of compliance for the RMZ exempt 20-acre parcels prescription type in 2008 led to the delineation of steps outlined in the 2011 Compliance Action Plan, to help increase the compliance rate for the RMZ exempt 20-acre parcels prescription type.
- Steps included: an FPA condition for landowners to notify DNR 48-hours prior to beginning harvest operations, and a minimum of two on-site forest practices forester evaluations during the active period of the FPA. Participation in the notification condition was not successful. Foresters successfully visited some of the FPAs twice.
- 2012 data shows the compliance rate has not significantly changed statistically since 2008.
- The FP program will pursue options to help improve compliance for this prescription type.

Haul Routes
The rate of compliance for haul routes in the 2012 assessment was 87%. Comparison between 2011 (96%) and 2012 rates shows that the rates are not significantly different statistically, which means they are considered the same. Both years' rates are near or above DNR's compliance goal of 90%.

Changes Made Based on CMP Feedback
One of the primary goals of the Compliance Monitoring Program is to provide feedback from compliance monitoring for the purposes of improving compliance with the FP rules. Following are some of the 2011-2012 changes made to address issues identified as a result of compliance monitoring:

Water Typing

- The Water Type Classification Worksheet and the Water Type Modification Forms have been revised to provide better detail about the location of water type breaks and stream physical characteristics.

- Water Type and Bankfull Width Training is currently being presented to all region Forest Practices Staff to help provide consistent statewide interpretation and understanding about how water types and bankfull widths are determined.

The effectiveness of these measures will be determined by future CMP results.

Shade Documentation

Review of the shade procedures by the CMP showed that there was no requirement for applicants to include a shade assessment with their FPA when harvesting within 75 feet of a Type S or F water (with the exception of exempt 20-acre parcels). As a result, the FP Program has revised the FPA form (July 2012) that directs all applicants to include the stream shade analysis (as per Board Manual Section 1) with the FPA.

1. Introduction

Photo by: Doug Couvelier

Compliance monitoring is a component of the Washington State Forest Practices program. Section 1.0 gives a brief history leading up to the development of the compliance monitoring program, an explanation of key factors/concepts regarding compliance monitoring and of forest practices rules that are monitored.

1.1 History and Context

The 1974 Forest Practices Act (FP Act) declared that "forest land resources are among the most valuable of all resources in the state" (Revised Code of Washington (RCW) Chapter 76.09). This law and its corresponding forest practices rules (FP rules) (Washington Administrative Code (WAC) chapter 222) regulate forestry activities on state and private lands in Washington State and are designed to both protect public resources on forestland and to ensure that Washington continues to support a viable forest products industry. Public resources are defined as water, fish, wildlife, and capital improvements of the state or its political subdivision. The FP Act created the Forest Practices Board (the Board), an independent state agency with 13 members. The Board, working with the public, stakeholder groups and the Department of Natural Resources (DNR), adopts FP rules and approves technical guidance (Forest Practices Board Manual or "Board Manual") which assists landowners in implementing the FP rules. The FP rules are administered by DNR (with input and consultation from other entities where directed in rule).

A flexible Forest Practices program (FP program) was developed as the foundation to implement the FP Act and rules because both knowledge and understanding of natural systems evolves and natural systems change over time. A flexible FP program is essential for meeting the intent of the FP Act in an arena where change is expected and on-going. FP program components that provide systematic feedback and facilitate change when needed have been intentionally designed and incorporated into the FP program. These components include the Compliance Monitoring Program (CMP), the Adaptive Management Program (AMP) and the Forest Practices Training Program (FPTP). Other FP program components that provide critical functions for implementing the FP Act and rules and also provide information to improve the FP program include forest practices application (FPA) review and FPA compliance and enforcement. When these components provide feedback that suggests change is needed to better meet the goals of the FP Act and rules, the Board can adopt new FP rules or guidance. Additionally, the FP program may adjust its operational practices, within the bounds of the FP Act and rules, to create some of the desired changes. Since promulgation of the FP Act in 1974, the FP program's flexible design has facilitated many changes to the FP rules and Board Manual as well as to the FP program.

One such change was the incorporation of the Compliance Monitoring Program into the FP program. CMP was not part of the original FP program established in 1974. The CMP was first formally proposed as an essential element in the 1999 Forests and Fish Report - a multi-stakeholder agreement that delineated acceptable measures to protect water quality and habitat for federally listed aquatic species and other riparian dependent species on private and State forestlands in Washington. The legislature enacted the Forests and Fish Report protection measures into law in 1999. As a result, compliance monitoring for forest practices became a legal requirement. The CMP was promulgated into FP rule in 2001 when the Board adopted FP rules that reflected the protection measures in the Forests and Fish law.

WAC 222-08-160(4) states: "Compliance monitoring. The department shall conduct compliance monitoring that addresses the following key question: "Are forest practices being conducted in compliance with the rules?" The department shall provide statistically sound, biennial compliance audits and monitoring reports to the board for consideration and support of rule and guidance analysis. Compliance monitoring shall determine whether forest practices rules are being implemented on the ground. An infrastructure to support compliance will include adequate compliance monitoring, enforcement, training, education and budget."

When funding for the CMP was allocated by the legislature in 2006, DNR, along with other stakeholders, developed a Compliance Monitoring program design and implemented an initial sampling effort in the spring of 2006. The CMP has completed annual compliance monitoring sampling every year since 2006. Additionally, the program has produced biennial reports starting with the 2006/2007 CMP Biennium Report showing results of field reviews, as directed by WAC 222-08-160(4), for consideration and support of rule and guidance analysis. All completed reports can be found on the compliance monitoring website: http://www.dnr.wa.gov/BusinessPermits/Topics/ComplianceandEnforcement/Pages/fp_cm_program.aspx.

The Compliance Monitoring Program is a key component of a feedback loop that intends to improve compliance with the forest practices rules that protect public resources and maintain a

viable forestry industry in Washington State. When sampling results provide sufficient information regarding a need for change, CMP reports include suggestions for potential changes that could help the FP program better achieve the goals of the FP Act and Rules. See Section 9 for a list of recent changes that resulted from CMP feedback.

1.2 Compliance Monitoring Program

Program Staffing: The Compliance Monitoring Program is directed by the DNR Forest Practices Assistant Division Manager for Operations. The program staff includes a program manager and a field coordinator along with funded participation of one full-time staff each from the Department of Ecology and Department of Fish and Wildlife. Additional assistance is provided by tribal members and other forest practices staff.

Reports: Field sampling of completed FPAs occurs annually and findings are presented in a biennial report as required in WAC222-08-160(4). In 2011 the Commissioner of Public Lands requested that the FP program also begin producing annual reports in the years that a biennial report is not required. This report is the first annual, or interim, CMP report and covers data samples collected during the 2012 field season (first year of the biennium cycle). Sample sizes in an annual report are too small to provide the designed statistical precision because the second half of the data is obtained in the second year of the biennium cycle. Consequently, with only half of the sample data represented, the findings, conclusions, and recommendations are limited in an annual report. The data from the 2012 and 2013 field seasons will be combined to produce the desired precision for statistical estimates and resulting comprehensive findings, conclusions, and recommendations and reported in the 2012/2013 biennial report scheduled for next year. Annual reports provide a current status of CMP sampling and allow the CMP to report results from Emphasis Samples that are completed in the first year of the biennial cycle a year earlier than would a biennial report.

Forest Practices Activities and Prescriptions:
Forest practices activities are operations such as timber harvest and forest road construction that are subject to FP rules. Prescriptions are groupings of similar rules that apply to a forest practices activity. FP rules are divided and grouped by like topic/application for monitoring purposes. For example, forest practices activity types such as road construction and timber harvest are evaluated based on options available for implementing a particular activity, such as the many options available for harvest in the RMZ (DFC Option 1, DFC Option 2, etc.); and by function/feature being protected such as shade, water quality and wetlands. In CMP reports these rule groupings are called prescription types. The CMP obtains data from samples and reports compliance monitoring findings by prescription type.

These prescription types allow for statistical estimation of compliance with specific rule groups rather than an overall forest practices compliance rate. This enhances the ability to determine where additional training or education or FP compliance efforts might be needed to increase compliance with FP rules. The CMP, with stakeholder input, determines which FP rule prescription types will be sampled each year and then estimates the number of samples required for statistical precision. This number of samples is then visited by the compliance monitoring field team for each of the FP rule prescription types.

Compliance: Each FPA is observed for compliance with two elements: first, how well the conditions on the ground – after completion of forest management activities – meet FP rules; and second, how well the conditions on the ground – after completion of forest management activities – meet what the applicant stated on the FPA. The first is called "rule compliance" and the second is called "FPA compliance." The compliance monitoring field team has found that deviation on a particular FPA can occur in one of the following three ways:

1. The conditions on the ground are in compliance with the FP rules but not with the FPA. For example, a landowner states on the FPA that s/he is going to leave an RMZ along the entire 1000-foot length of the Np stream in the harvest area, but upon completion of harvest only leaves a buffer along 700 feet of the stream length. The 700-foot RMZ buffer is still in compliance with the FP rules because the FP rules do not require the entire length of an Np stream to be buffered. However, the 700 feet is not in compliance with what the landowner stated would be done on the FPA.
2. The conditions on the ground are in compliance with the FPA but have deviated from the FP rules. For example, an applicant incorrectly measures the width of the stream in the FPA area and states on the FPA that the stream falls into a smaller (incorrect) width category that requires less protection. Subsequently, if the applicant implements the forest practices activity using the incorrect protection measures, the forest practice has deviated from the FP rules but is not out of compliance with what the applicant stated on the FPA.
3. The conditions on the ground deviate from both the FP rules and the FPA.

The primary intent of the CMP is to determine on-the-ground compliance with the forest practices rules or "rule compliance." However, understanding deviation from the FPA or "FPA compliance" can help DNR determine whether improvements should be made in application forms, application instructions or other methods of landowner outreach and education. Information regarding both types of deviation helps to advise the efforts of the FP program with the intent of improving compliance with the FP rules.

*Compliance Monitoring Scope Limitations: C*ompliance monitoring is limited by mandate, budget, and staffing which results in a focused program with a well-defined, yet limited, scope. Compliance monitoring does not:

- Focus on individual landowners and compliance specific to those landowners, but rather focuses on the two overall groups of small and large forest landowners.
- Track FP rule violations – when field reviewers encounter rule violations, the appropriate DNR regional staff is notified for further action, or
- Modify water types - field reviewers do, however, record observed differences between water type documentation on FPAs and on-the-ground physical features. See section 3.1.

1.3 Forest Practices Rules

Overall, FP rules provide protection for many riparian and upland species and their forest habitat as well as protection for water quality. Currently, compliance monitoring has focused on rules that protect aquatic and riparian species habitat. FP rules that help protect aquatic and riparian species habitat include rules regarding:

- Riparian protection,
- Wetland protection,

- Shade,
- Water typing,
- Road construction, maintenance, and abandonment near water, and
- Harvest or road construction on unstable slopes.

Budget and staffing preclude the ability to monitor with statistical precision all FP rules that might affect aquatic and riparian species habitat, as well as upland habitat. The CMP prioritizes rule sampling based on a forest practices activity's potential to impact public resources.

While maintaining adequate shade is an important part of riparian prescriptions, the forest practices shade rules are not yet being sampled. Consequently, the riparian descriptions throughout the remainder of this report do not include shade even though it is integral to the overall protection provided in riparian areas. When the CMP initiates sampling for shade compliance, CMP reports will include appropriate information regarding FP shade rules, their on-site review and results.

Following are CMP's prioritized rules chosen for sampling during the 2012 field season.

Standard Sample:
Certain specific FP rule groups are sampled every year and are considered to be part of the CMP "Standard" Sample. These include:

- Riparian rules: Western Washington and Eastern Washington riparian management zone rules (WACs 222-30-021 and -022,
- Road construction and maintenance rules (WAC 222-24),
- Wetland rules: (WAC 222-30-020(7); and WAC 222-24-015), and
- Haul Routes (WAC 222-24) for sediment delivery.

Emphasis Sample:
Other FP rule groups are sampled, as needed and budgets allow, and are considered to be "Emphasis" Samples. These other FP rule groups govern activities that are utilized less often than the rules sampled in the Standard Sample. The smaller population size usually leads to the CMP sampling a higher proportion of the total Emphasis population than is sampled in Standard Samples.

There is one Emphasis Sample for the 2012 reporting period – Riparian management zones (RMZ) for exempt 20-acre parcels (WAC 222-30-023).

2. Compliance Monitoring Design and Methodology

The compliance monitoring design was developed to be a consistent and repeatable field-based method to determine if forest practices are conducted in compliance with FP rules. Compliance monitoring design details are found in the document *Washington State Department of Natural Resources Forest Practices Compliance Monitoring Program design and Compliance Monitoring Protocols.* Section 2.0 explains key design and methodology concepts used in the forest practices compliance monitoring program.

2.1 Population and Sample Selection

The population designated for sampling consists of forest practices applications that have completed forest practices activities but are not yet expired (FPAs are approved for a specified number of years). Each application states all of the forest practices activities the landowner intends to implement. This information allows the compliance monitoring field team to locate FPAs that list the particular FP rule prescriptions being sampled that year. The list of FPAs that contain the prescriptions being monitored that year constitutes the pool from which sample selections are drawn.

Landowner population groups

CMP reports provide riparian and road compliance findings separately for small forest landowners and industrial landowners in addition to the findings for all landowners combined. To date, sample sizes for small forest landowners have been too small to achieve sufficient

statistical precision for conclusions regarding small forest landowners as a separate landowner group. While it is a goal of the CMP to eventually obtain sufficient data to draw conclusions for both industrial landowners and small forest landowners separately, sample size, budget and staffing currently preclude the ability to do so.

Sample Selection

There are thousands of active (not yet expired) FPAs every year because FPAs have multi-year life spans that are different. (There were approximately 10,000 active FPAs in fiscal year 2012). Each FPA has an expiration date. To assure that all active FPAs have an opportunity to be selected, the CMP determines the population to be FPAs that expire between April 1 of the year field work is taking place and March 31 of the following year. For the 2012 sample this included 2,797 FPA's (including FP notifications – see Glossary). Using the April 1 to March 31 window also improves the likelihood that the forest practices operations are complete prior to the primary compliance monitoring sampling months, February through November, and that the compliance monitoring field team visits the site before the FPA expires.

To provide a random selection of FPAs from the sampling population, the FPAs that expire between April 1 and March 31 are assigned a random number as a decimal fraction between 0 and 1, and then ordered from the smallest to the largest number. The selection methodology involves reviewing the FPAs in this random order. Each FPA is reviewed to determine which, if any, of the sample FP rule prescription types being sampled that year occur in the FPA. This selection process continues through the ordered list of FPAs until the target sample size is reached for each prescription type.

Standard Sample FP rule prescriptions monitored annually are shown in Table 1. Emphasis Sample FP rule prescriptions during the 2012 season were limited to Riparian Management Zones for exempt 20-acre parcels.

Table 1: Standard Sample Prescriptions Monitored in 2012

<table>
<tr><th></th><th>Sampled Statewide</th><th>W. WA only</th><th>E. WA only</th></tr>
<tr><td rowspan="2">Roads</td><td>Road Construction and Abandonment</td><td></td><td></td></tr>
<tr><td>Haul Route</td><td></td><td></td></tr>
<tr><td rowspan="5">Harvest</td><td>RMZ -Type Ns Prescriptions</td><td></td><td></td></tr>
<tr><td>RMZ -Type Np Prescriptions</td><td></td><td></td></tr>
<tr><td>Wetlands</td><td>RMZ -Type F or S Inner Zone Harvest (DFC Option 1)</td><td rowspan="2">RMZ -Type F or S Inner Zone Harvest</td></tr>
<tr><td>RMZ - Type F or S No Outer Zone Harvest</td><td>RMZ -Type F or S Inner Zone Harvest (DFC Option 2)</td></tr>
<tr><td>RMZ - Type F or S No Inner Zone Harvest</td><td></td><td></td></tr>
</table>

Sample Size and Confidence Values
Standard sample: In the biennium compliance monitoring design used by the CMP, the Standard Sample (Emphasis Samples are different) uses a conventional significance level of 95%. Associated with the 95% significance level, the CMP set a desired half-width of the 95% confidence interval (CI) to be 12%. These choices reflect the program's intent to obtain the highest level of confidence that could be obtained within the budget allocated to the CMP. A 95% CI of width +/- 12% means that if we repeated the sample 20 times we would expect the population mean (the "true" compliance rate) to lie within the confidence interval 19 out of 20 times. The CMP sets the sample size to provide an approximate +/- 12% confidence interval for the compliance rate of each prescription type for the biennium. This sample size is an estimate based on assuming the compliance rate is similar to historical values. Because the population of FPAs in any given year is finite, the size of the population impacts the variance of compliance rates, and, by extension, the width of confidence intervals and the estimated sample sizes. Thus, rare prescriptions need fewer samples to attain the desired precision levels. Estimated population sizes for each prescription are used in the sample size estimation to estimate a "Finite Population Correction Factor". This means a smaller sample is required than would be for an infinite population. See Appendix A form more information.

It is important to keep in mind that sample sizes in an annual report, such as this one, are too small to provide precise statistical estimates because observation and data collection is based on a two year model with approximately half the samples observed in the first year and half the samples observed in the second year. Two years are needed to obtain enough samples to attain the desired level of statistical precision.

Standard Sample estimated population and sample sizes for each prescription type in 2012 are shown in Table 2. Population sizes for each prescription type are estimated based on the proportion of the entire population viewed to reach the desired sample size. Total population sizes for prescription types are estimated because it would take many hours, which are not available, for staff to review each of the 2,747 FPAs to find the exact population count for each prescription type. See Appendix A form more information.

Table 2: 2012 Standard Sample Count by Prescription Type

Geographic Region	Prescription Type	Sample Count	Estimated Population of FPA s with the Prescription
Statewide	Road Construction and Abandonment	18	633
	Haul Route	32	NA
	RMZ - Type Ns Prescriptions	14	449
	RMZ - Type Np Prescriptions	16	571
	Type A Wetlands	12	54
	Type B Wetlands	10	105
	Type Forested Wetlands	8	118
Western Washington	RMZ - Type F or S No Outer Zone Harvest	14	54
	RMZ - Type F or S No Inner Zone Harvest	25	181
	RMZ - Type F or S Desired Future Condition Option 1	11	13
	RMZ - Type F or S Desired Future Condition Option 2	16	95
Eastern Washington	RMZ - Type F or S No Outer Zone Harvest	6	17
	RMZ - Type F or S No Inner Zone Harvest	12	40
	RMZ - Type F or S Inner Zone Harvest	0	0

Table 2 shows the actual sample count by prescription type during this field season. In some cases the actual sample size did not match the planned sample size for the year. The three primary reasons for this discrepancy are: 1) inadequate time to collect samples in a shortened field season due to a vacant field coordinator position, 2) occasional loss of samples because sites were disqualified for a particular prescription after field inspection, and 3) correction to population size estimates, which reduced the number of samples necessary for adequate two-year statistical precision. The compliance monitoring biennial sample design allows the program to compensate for any inadequacies in 2012 sample sizes by increasing samples to be observed in the upcoming 2013 field season. It is anticipated that sample sizes for the 2012 and 2013 field seasons together will provide the desired statistical precision for the 2012/2013 biennial report.

Emphasis Sample

The 2012 Emphasis Sample monitored RMZ exempt 20-acre parcels. This is the second time since the initiation of the CMP that RMZ exempt 20-acre parcels have been sampled. The first sampling was in 2008. As mentioned previously, sampling designs for Emphasis Samples are

different than designs for Standard Samples because the overall population size of an Emphasis Sample is far smaller.

Initially, the CMP made two decisions regarding sampling for RMZ exempt 20-acre parcels: first, to draw from the population of FPAs approved from June 2011 through June 2012, and second, to match the same sample size (45 samples) that was used in the 2008 RMZ for exempt 20-acre parcel sample.

The beginning sample period of June 2011 was chosen to coincide with the start date of new FPA processing guidance asking landowners to notify the DNR office within 48 hours prior to starting work on their RMZ exempt 20-acre exempt parcels.

The actual sample size for the Emphasis sample was less than the original goal of 45. DNR receives, on average approximately 102 FPAs (2.2% of total FPAs submitted) associated with RMZ exempt 20-acre parcels per year, but the available population for 2012 began with 70 FPAs. The intent was to randomly select a sample of 45 from the 70 FPAs. However, upon examination only 27 of the 70 FPAs had completed harvest activities. The CMP chose to do a census sampling of all 27 of the completed RMZ exempt 20-acre parcel samples for the period. Since a census is not a sample, the compliance rate reflects the entire population with no confidence interval necessary.

Observations for the RMZ exempt 20-acre parcel samples focused on harvest adjacent to Type F and Type Np waters.

2.2 Field Review and Data Collection

The compliance monitoring field team uses two primary data collection methods, field observations and field measurements, to determine whether the applicant met the requirements of the forest practices rules while implementing forest practices activities. Field observations are visual assessments which help provide answers to the questions asked on CMP field forms. Specific measurements are taken to determine such attributes as tree/stump counts, RMZ length, RMZ width, and Bankfull width. Examples of types of field observations and field measurements follow.

Riparian Harvest

- Observations:
    - Presence of alluvial fans, headwall seeps and springs
    - Location of uppermost point of perennial flow
    - Presence of unstable slopes

- Measurements:
    - Bankfull width (BFW) – Bankfull width is measured for Type S, F, and Np waters except where the stream obviously exceeds or is below a threshold width (i.e. under or over 10 feet in western Washington; but under or over 15 feet in eastern Washington). The channel width is measured (using a tape measure) at even intervals along the stream reach within the boundaries of the FPA. The goal is to

obtain a minimum of ten measurements, but if the reach is 300 feet or less, a measurement interval of 25 feet is used.

- Stream length – Stream length is measured using a hip chain. The length is used to determine the intervals for BFW measurements and RMZ width measurements.
- RMZ and wetland management zone (WMZ) width – RMZ width (and the three zones within the RMZ) and WMZ widths are measured using a laser hypsometer to ensure accurate horizontal distances. Lasers with reflectors (placed on trees) are used to ensure measurement precision. RMZ zone widths are marked with ribbon for visual reference.

Road Construction and Abandonment and Haul Route Assessment
The assessment of road construction and abandonment is based on answering a series of questions found on the CMP Road field form. The questions address observed site conditions based on the required management practices in FP rule (WAC 222-24-010, 020, 030, and 040). The assessment of haul routes is based on observation of fulfillment of road rule requirements and on professional judgment from CMP participants used to rate sediment delivery levels resulting from each haul route.

2.3 Compliance Assessment and Ratings

The compliance monitoring field team makes two determinations regarding each sample in a prescription type. The first determination is whether the sample is compliant or has a deviation from an FP rule. The second determination is the level of compliance or deviation which is referred to as a "rating".

Compliant/Deviation Determination:
The purpose of this section is to provide the reader a more comprehensive understanding of compliance with the FP rules across the landscape and how that compliance is measured and reported by the CMP. Compliance percentages in CMP reports don't represent a complete picture of compliance with the rules because there are varying levels of compliance that are difficult to summarize in a quantitative way. To recognize this, beginning with this report, the terminology used to describe compliance has changed. In past CMP reports, prescriptions have been described as "Compliant" or "Non-compliant." Beginning with the 2012 report, prescriptions are considered as "Compliant" or a "Deviation" from the rules. Estimation for the "Compliant" category is the same as in past CMP reports. The "Non-compliant" category has been relabeled to more accurately acknowledge that while a prescription as a whole may deviate from the FP rules, several of the FP rules that comprise the prescriptions may be compliant. Section 1.2 explains that prescriptions are a grouping of FP rules. These groups were constructed by the CMP for the purposes of estimating compliance. The following example illustrates this concept.

The DFC Option 2 (Leaving Trees Closest to the Water) prescription is not a single FP rule but rather a grouping of several rules, some of which are listed below:

- Core zone – "No timber harvest or construction is allowed in the core zone",
- Inner zone – "Forest practices in the inner zone must be conducted in such a way as to meet or exceed stand requirements" (see Glossary),

- Inner zone – “Harvest is not permitted within 30 feet of the core zone for streams less than or equal to ten feet wide”,
- Inner zone – “Trees are selected for harvest starting from the outer most portion of the inner zone first”,
- Outer zone – “Timber harvest in the outer zone must leave twenty riparian leave trees per acre”,
- Outer zone – “Dispersal strategy-riparian leave trees, which means conifer species with a diameter measured at breast height (DBH) of twelve inches or greater, must be left dispersed approximately evenly throughout the outer zone.”

These six rules are only a few of the FP rules that are part of the “DFC Option 2” prescription type. When the DFC Option 2 prescription type in a CMP report is shown with a percent compliance of 63%, it is referring to the number of sampled FPAs that are compliant with every FP rule included in the DFC Option 2 prescription type. The corresponding “Deviation” category includes any FPAs that are a part of the DFC Option 2 sample that deviated from at least one of the FP rules included in the prescription type.

It is important for the reader to keep in mind that the percentages for compliance in CMP reports for prescriptions only represent the number of prescription samples that showed compliance with every FP rule in the prescription type and do not represent the total picture of compliance to all the relevant FP rules (with the exception of the haul route prescription type).

At this point a natural question to ask is “Why is compliance with the FP rules conducted and reported this way if it does not represent the whole picture of compliance?” There are two directions to take when estimating this type of compliance.

1) The first direction is to estimate a percent compliance for each individual FPA, then average these percentages across FPAs to estimate overall statewide compliance. In some ways, this method would provide a better picture of overall compliance. However, this approach is complicated.

   There needs to be a quantitative way to estimate a percent of compliance across rules within a prescription. The discussion of “Deviation Ratings” below categorizes the deviation into groups. For the “average compliance” method discussed here, these levels of deviation would require quantitative assignment. For example, if there are 10 rules for the prescription, 9 of them are compliant, and 1 is half-way compliant, would we say the FPA is 95% compliant? 90%? Are all of the rules to be considered equally? Even within a given FP rule, the level of compliance will vary. The FP rules are primarily structured in a way that the landowner must meet a minimum or maximum threshold (ex. minimum number of trees, minimum buffer width, etc.). This is different from meeting an average value where statistical tools can be used to develop percentages.

2) The second direction, the one chosen by CMP at the beginning of the program, is to assess each FPA containing a given prescription and assign it a compliance category labeled “Compliant” or “Deviation”. Although we can expand the number of categories by dividing "compliant” or “deviation” into subcategories, the estimation of proportions for multiple categories requires more samples for more precise estimates.

While prescription types are directed by many different FP rules, the program so far has not found a way to statistically combine all the separate rules which constitute compliance into a quantitative compliance statistic for a single application of a prescription.

Nonetheless, it may be important for decision makers to understand the meaning and severity of deviation from FP rules. To aid in this understanding, compliant and deviation assessments are assigned a compliance rating. Compliant prescriptions are rated as those that are "compliant" and those that "exceed rule requirements". Prescriptions that deviate from the FP rules are rated as "minor," "moderate" or "major" or are called "indeterminate" when the compliance monitoring field team cannot determine how to rate the deviation. These ratings help the reader understand the potential impact of the deviations from FP rule on public resources.

Compliance Ratings Descriptions:
This section describes five compliance ratings that are applied after the compliant/deviation assessment is made. There are two ratings for a compliant assessment including "compliant" and "exceeds rule requirements." There are three ratings for a deviation assessment including "minor", "moderate", or "major". There is also an "indeterminate" category as part of the deviation assessment.

Compliant Rating Determinations:
Compliant means that a prescription meets all relevant FP rule requirements and/or what was stated on the approved FPA. By signing and submitting an FPA, a landowner is conveying the intention to conduct specific forest practices activities on lands with specific site characteristics as described on the FPA. The landowner's signature on the FPA is the acknowledgement that the landowner understands that FP activities must comply with the FP Act and rules.

- Compliant Rating:
  The prescription type is completely compliant with every FP rule included in the prescription.
- Exceeds Rule Requirement Rating:
  Applicants sometimes choose to provide more protection than is required in the FP rules while implementing their forest practices activities. It is important for the CMP to acknowledge those additional protection measures taken by the landowner. CMP recognizes these instances because by doing so, the landowner often provides additional ecological function and protection for public resources. Currently the compliant rating of "Exceeds rule requirements" is limited to the following:
  - For Type S or F Waters: Twice as many trees in the RMZ inner and outer zones were retained than was required by rule. For No Inner Zone Harvest this would be twice as many Outer Zone trees only.
  - Type S, F, or Np Waters: RMZ width is consistently 20% wider than required by rule.
  - Type Np Waters: No cut RMZ length is at least 20% greater than required by rule.
  - Road improvements were more protective than required by rule (e.g. 24-inch cross drains instead of 18-inch; paving portions of road; etc.).

    - Road abandonment activities (e.g., mulching, distribution of trees and woody debris along road prism to deter off-road vehicle travel) were more protective than required by rule.

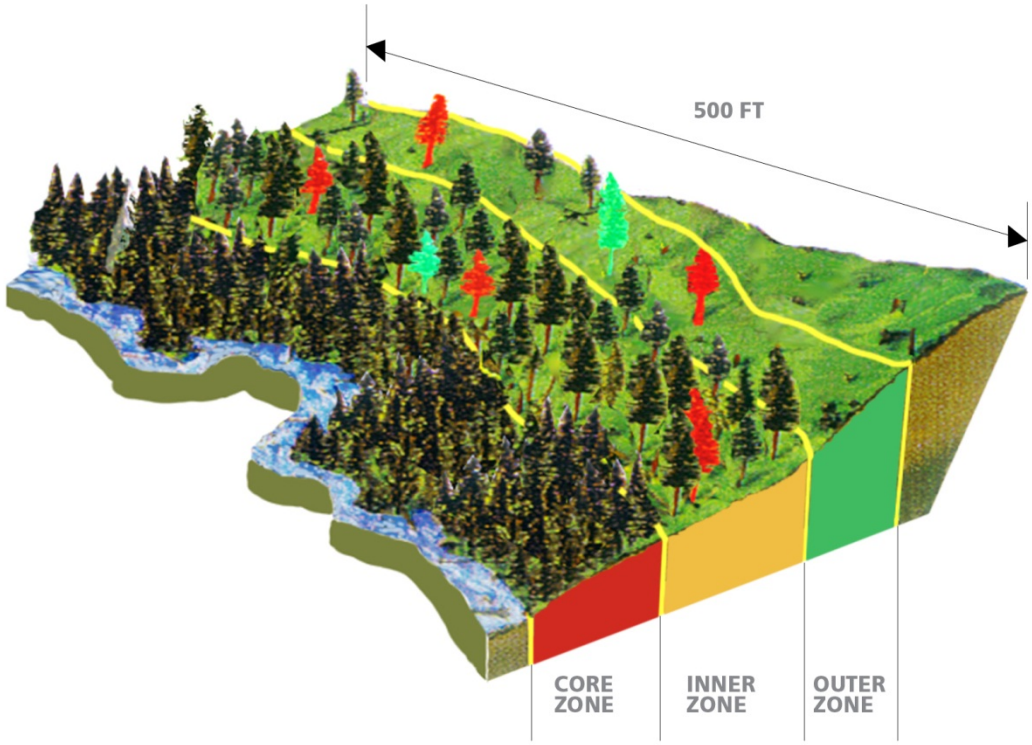
Deviation Rating Determinations:
Deviation means that a prescription does not meet at least one FP rule within the prescription type and/or what was stated on the approved FPA. In order to obtain a sense of the magnitude of the deviation and a sense of where DNR might focus training efforts to improve compliance, the compliance monitoring field team uses professional judgment to rate noncompliant activities. There are three ratings categories: minor, moderate, and major as well as an indeterminate call. The following guidelines are examples used to assist professional judgment when rating the impact of deviation in the field:

- Minor Deviation – Minor impacts of short duration over a small area. Examples include:
    - A few trees harvested in the inner or outer zone of the RMZ of the same species and equal or lesser diameter as the remaining trees in the RMZ.
    - Evidence of slight sediment delivery that does not appear to be persistent.
- Moderate Deviation – Potential impacts to resources, but generally of moderate effects. Examples include:
    - The required outer zone trees are not retained.
    - More than a few required leave trees have been harvested from a no harvest inner zone.
    - Culvert sizing is questionable, but potential impact to resources is not readily apparent.
    - Soil stabilization has not occurred on road cuts, fills or water crossings and there is significant potential for sediment delivery above background levels to typed water.
- Major Deviation – Damage to public resources is evident or the potential for damage is high. Examples include:
    - Significant harvest of the required leave trees in the inner zone.
    - Harvest in areas not delineated on the FPA.
    - Evidence of direct sediment delivery to typed water.
- Indeterminate – The prescription is out of compliance but the compliance monitoring field team cannot determine the level of non-compliance.

The following examples of deviation from FP rules illustrate that there is a level of compliance for many of the rules included in a prescription type even when they are assessed as “Deviation” and shows the process of assigning ratings to the deviation.

Figure 1 illustrates a riparian harvest using average data from the fifteen 2012 samples of Type S and F waters assessed as a deviation rated as minor. A riparian zone harvest is subject to a number of complex FP rules. In this example, the applicant followed multiple FP rules by typing the stream accurately and measuring the stream width correctly; correctly measuring the core, inner, and outer zone widths; correctly assessing the number of surplus trees according to the desired future condition (DFC) modeling; and leaving the core zone intact and harvesting the correct number and type of trees in the inner zone.

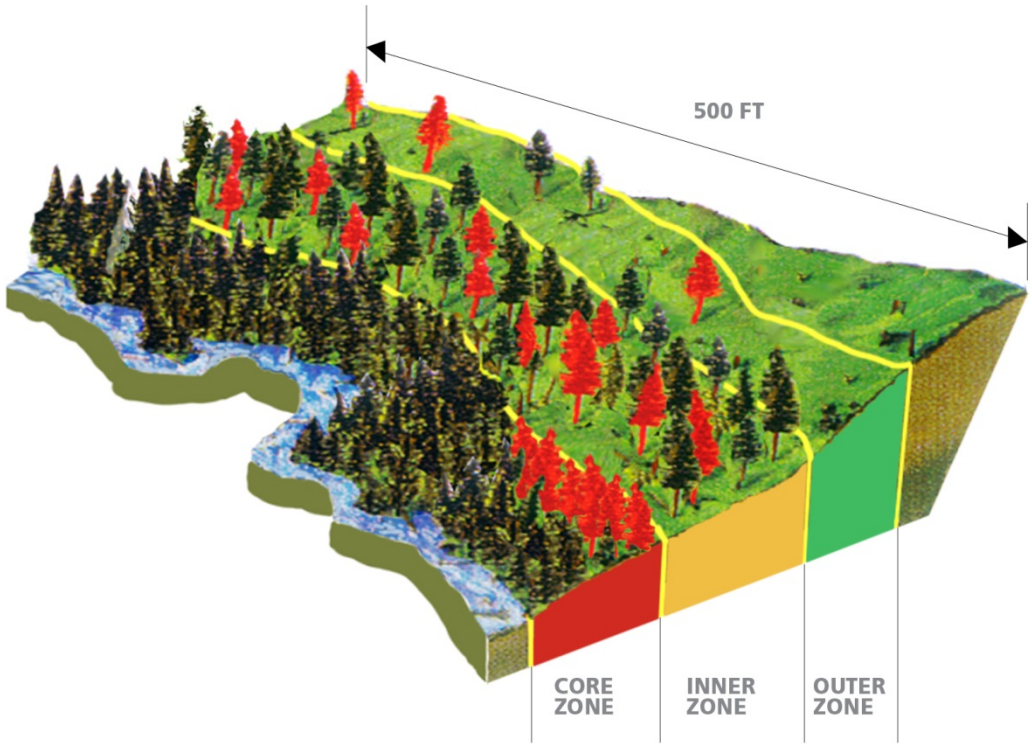
Figure 1 – Inner Zone Harvest with Deviation rated as Minor



The red trees in the image represent trees which were required by rule to be left but were harvested. An offsetting factor in representation of the average is that while two trees too many per 500 feet were taken out of the outer zone, and three trees too many were harvested from the inner zone, an additional one tree each that had not been required to be left was left in the inner zone and in the outer zone. These are represented in Figure 1 by the lime green tree outlines.

In contrast, Figure 2 below illustrates an example of inner zone harvest assessed as a deviation rated as major. Figure 2 uses average data from the two 2012 samples assessed as a deviation rated as major on fish bearing waters. In this scenario, the landowner planned a riparian zone harvest and followed all of the same forest practices rules as noted in the example above, except that harvest rules were not followed completely in any of the three zones. Primarily, core zone trees were harvested, as were many inner zone trees and outer zone trees that were required to be left.

Figure 2 – Inner Zone Harvest with Deviation rated as Major



In Figure 2, 11 trees are missing per 500 feet of Inner Zone and three trees are missing per 500 feet of outer zone. Additionally some harvest occurs in the core zone.

Of the two examples above, the scenario illustrated in Figure 2 with deviation rated as major has a much greater potential to impact two primary functions provided by the inner zone of the riparian area – large woody debris and shade. The scenario illustrated in Figure 1 with deviation rated as minor has much less probability of a measurable impact on riparian functions.

The expectation is for landowners to follow all relevant FP rules. But there is more to evaluating compliance with the FP rules than simply a compliance rating for prescription types. The CMP continues to work toward finding better ways to report a more complete picture of compliance.

2.4 Design/Methodology Changes

Section 2.4 discusses changes made to compliance monitoring sampling design or methodologies. Changes occur when CMP participants discover ways to improve the system.

Sample Strategy in 2012: The program made significant changes in the 2012 sample design to increase confidence in statistical estimates of each prescription type observed.

From 2006 through 2011 the Standard Sample design was based on random selection of FPAs stratified by each region's proportion in the population. One instance of each prescription type occurring on the FPA was observed. This strategy allowed combining statistics across

prescription types so overall compliance rates for FP rules could be reported. This was initially considered important but the strategy had challenges. For example:

- A combined statistic can cause confusion because compliance monitoring does not sample all forest practices rules, as explained in section 2.3 above. A reader might incorrectly believe that the one combined statistic represented the compliance rate for all FP rules.
- The strategy also caused problems with sample sizes among prescription types. For example, more common prescriptions had larger sample sizes of approximately 70 while less common prescriptions had fewer than 10 samples. The confidence intervals of the least used prescription type means (averages) were very wide (which results in a lower confidence in the statistic) and the small sample sizes provided little information about the cause of the non-compliance.

A decision was made late in 2011 to change the selection design to randomly select instances of each sampled prescription type occurring in the population. An estimated sample size is calculated for each prescription type which meets a desired confidence interval for a biennium sample. This change in selection design allows for both a higher statistical confidence in results and provides a larger information set to help determine causes for deviation from FP rules.

Drawbacks to the new selection design includes significantly more time required for up-front preparation in the sample selection process and the need for the compliance monitoring field team to visit 1.5 to 2 times more FPAs to obtain enough samples to produce statistically precise data. A time savings offset to the increased workload occurred due to having fewer prescriptions to observe on each FPA. Staff capacity to handle the increased workload is currently possible because of the time savings offset and the recent improvements to the compliance monitoring data entry and database management processes.

Overall the change in selection design is viewed by the CMP as an improvement. It allows future flexibility to add or remove different prescription types from the sample as needed while still providing the desired confidence intervals for each prescription type.

2.5 Compliance Monitoring Challenges

Challenges are not uncommon for any complex assessment program. This section reviews current challenges for the CMP.

Representation of Complete Compliance:
Accurately representing the complete picture of compliance has proven to be difficult. While prescription types have many different FP rules directing them, the program so far has not found a way to statistically combine all the separate rules which constitute compliance into a quantitative compliance statistic for a single application of a prescription. This also means a meaningful average percent compliant for a prescription cannot be provided. The CMP continues to work toward finding better ways to report a more complete picture of compliance.

Sample and Measurement error:
Sampling error occurs when rule or board manual guidance specifies that average values are to be used during the layout of a specific prescription type. This is because averages vary

depending on where measurements are taken. It is unlikely that the compliance monitoring field team can duplicate the exact same ten measurements made along a stream reach for calculating stream width as were measured by a landowner. The result is that the compliance monitoring field team's average stream width value is likely different from the landowner's average stream width value. Statistical analysis techniques, such as a variability study to determine error tolerances have not yet been pursued by CMP to help determine if a landowner's average measurement that is slightly different from the compliance monitoring field team's average measurement is considered the same or not (statistically speaking "significantly different"). The CMP resolves the inability to determine statistical variability on average values by assigning an absolute 5% measurement error tolerance. This measurement error tolerance applies for only two specific measurements, when determining: 1) stream widths (for a 10-foot-wide stream this would be 6 inches), or, 2) buffer widths or floors within no-harvest RMZ areas. When a landowner's average value is within 5% of the compliance monitoring field team's average value the values are considered the same. If the landowner's average value falls outside the 5% it is assumed the compliance monitoring field team value is correct and the landowner's average value is incorrect.

Variation in Natural Conditions:
Natural systems such as forests are highly variable and difficult to measure with precision. Forest Practice rules require precise measurements to implement forest practices activities. Applying precise measurements becomes difficult for forest practice activity implementation as well as for FPA compliance and compliance monitoring. When precise measurements required in the FP rules are confounded by variable site conditions, the CMP follows the most protective interpretation of the FP rules to determine compliance.

A frequent example of precise FP rules conflicting with imprecise on-site conditions occurs when a stream reach has FP rule-defined characteristics of both a Type Np stream and a Type F stream. Type Np streams are considered to be streams over 20% gradient that have a perennial flow and Type F streams that are defined as having a gradient equal to or less than 20%. Often sections of stream reaches have gradients that are over 20% and sections less than 20%. When the compliance monitoring field team finds a stream reach that has a general gradient under 20% but also has small sections that are greater than 20%, the compliance monitoring field team considers the stream a Type F stream.

Shade
The design/methodology changes discussed in section 2.4 above resulted in the review of more prescriptions subject to the 75-foot shade rule during the 2012 field season than had been reviewed in previous years. This broader scale review revealed problems with the existing compliance monitoring protocols used to assess shade compliance. These problems could result in erroneous assessments of whether the post-harvest RMZ meets the shade conditions expected under the rule.

Shade requirements (WAC 222-30-040) apply within the first 75 feet from outer edge of bankfull width or channel migration zone (whichever is greater). Within the bull trout overlay (see Glossary), all available shade must be maintained within the 75 feet. Outside of the bull trout overlay, the temperature prediction method (described in Board Manual Section 1) is used to

determine if any trees may be harvested within the 75 feet. No tree may be harvested if it is providing shade to the stream necessary to maintain compliance with stream temperature standards. When landowners chose to remove a tree within the 75 feet, the landowner must demonstrate, using the temperature prediction method in the board manual, that the removal of the tree would not be contrary to shade needed to maintain compliance with temperature standards WAC 222-30-040(2).

The shade rules are different than most rules monitored by the CMP in that the shade rules both: a) direct a pre-harvest site assessment predicting post-harvest site conditions, and b) direct that the post-harvest stand and site conditions meet certain criteria. That is, the shade rule addresses both the condition of the stand in the RMZ post-harvest as well as a condition that the landowner must demonstrate that any trees to be harvested within 75 feet from BFW would be in excess of the trees required to be left to meet stream temperature standards. This is different from CMP's normal review of other riparian prescriptions which address only the post-harvest stand and site conditions.

This pre-harvest "demonstration" required by the FP rules is a challenge to the CMP for two reasons. First, documentation submitted with the forest practices application to DNR can fulfill the "demonstration" requirement for shade; yet, CMP protocols are not currently designed to determine the adequacy of information submitted with the FPA that document pre-harvest site assessment for shade. And second, to date, FPAs have not required shade documentation to be submitted (until the most recent 2012 FPA version) in order to be approved, and, therefore, no shade documentation is currently available to use for compliance monitoring purposes.

There is also an issue regarding field measurements for determining shade compliance post-harvest that precludes the ability to monitor the shade rules. There are concerns of attaining measurement repeatability using the densiometer (the instrument that is used to determine shade). The issues of repeatability come into play because it is difficult for different users to get the same results and the same user may get different results at different times of the year.

While accurately representing the complete picture of compliance, sampling error, the variability of natural conditions and shade compliance present challenges to the program, the CMP seeks to find the best solutions for overcoming these challenges.

3. Forest Practices Rule Compliance for Water Types, and Riparian, Wetland, and Equipment Limitation Zones

Forest Practices rules are designed to protect aquatic resources and related habitat adjacent to typed waters and wetlands when forest practices activities are proposed. Riparian and wetland areas provide fish, amphibian, and wildlife habitat and protect water quality. A riparian management zone (RMZ) is the area that is adjacent to Types S, F or Np streams (see water types below) where trees are left unharvested to provide functions required by aquatic and riparian species and for protection from disturbance. A wetland management zone (WMZ) is the area located around the perimeter of a wetland where trees are left to provide protection from disturbance, as well as shade and nutrients for the wetlands. Both RMZ and WMZ buffers filter runoff to minimize sediment entering water; provide long-term large woody debris recruitment and organic material crucial for fish and amphibian habitat; maintain shade to help regulate stream temperatures; and provide amphibian and wildlife habitat. Protection on Type Np and Ns streams also include an equipment limitation zone (ELZ). This is a 30-foot-wide zone adjacent to Type Np and Ns streams. There are limitations on equipment use within the zone and on-site mitigation measures are required if activities expose the soil on more than 10% of the zone.

FP rule protection measures that guide timber harvest options within RMZs depend upon the water type (Type S, F, Np, Ns), width of the stream (bankfull width), and the site class (I, II, III, IV, V) of the RMZ. Wetland protection depends upon the type and size of the wetland.

Section 3.0 provides FP rule and on-site review descriptions, and compliance monitoring findings for:

The Standard Sample:

- Water type observations,
- Western Washington RMZ
- Eastern Washington RMZ, and
- Statewide wetlands.

And the Emphasis Sample which includes:

- RMZs for exempt 20-acre parcels.

While maintaining adequate shade is an important part of riparian prescriptions (see section 2.5), the forest practices shade rules are not yet part of the FP rules being monitored. Consequently, the riparian descriptions throughout the remainder of this report do not include shade even though it is integral to the overall protection provided in riparian areas. The CMP will initiate sampling for shade compliance after the program has methods suitable to produce relevant information.

Findings are limited in this report (and all annual reports) because sample sizes are smaller, representing half of the biennial sample. Caution must be taken when attempting to draw meaningful conclusions from the results provided in an annual report. The data and findings shown below may or may not be an indicator for upcoming findings that will be provided when both the 2012 and 2013 field season data are combined and reported in the 2012/2013 biennial report scheduled for next year. The CMP is offering the following compliance monitoring findings primarily as a status update of CMP sampling and to report the completed findings from the riparian management zones for the exempt 20-acre parcels Emphasis Sample.

3.1 Statewide Water Type Observations

In the initial years of compliance monitoring, compliance monitoring field team observations indicated that at times water types observed on-the-ground did not match water type classifications provided on submitted and approved FPAs. This led to a concern regarding consistency and accuracy of water type information on FPAs because the width and length of riparian buffers required under FP rules are directly linked to water type. In the FP rules, water is classified in specific stream and wetland categories or “types” based on several factors (WAC 222-16-030, 031, 035). Stream and wetland type classification is a fundamental aspect of determining which FP rules apply to forest management activities taking place adjacent to typed water. Specific FP rules apply to specific water types because different water types fulfill unique and cumulative functions for aquatic and riparian species and water quality. Waters of the state were initially classified by type using local knowledge and ortho-photos and represented on a set of water type maps. Currently, the public can find information about the water type assigned to a

particular stream on the FPARS Mapping Site: http://fortress.wa.gov/dnr/app1/fpars/index.htm. Because waters depicted on DNR water type maps were originally typed without a field visit, the maps can display incorrect water types and must be field verified prior to FPA approval.

FP Rules for Water Type

Forest Practices water typing rules define four types of streams (S, F, Np, and Ns) and three types of wetlands (forested, non-forested Type A, and non-forested Type B). The four types of streams are classified in a hierarchical manner based on stream function and level of protection required for the stream. Following are the stream types in hierarchical order starting with the highest level (requiring the most protection).

- Type S streams are at the highest level of classification and are considered fish bearing streams that are Shorelines of the State as designated by the Washington Department of Ecology.
- Type F streams are the second highest level of classification and either have fish or specifically defined human uses or both.
- Type Np streams fall next in the stream hierarchy. These are non-fish bearing streams that have a perennial flow of water year round during a normal rainfall year that include intermittent dry portions of the perennial channel.
- Type Ns streams are the lowest level streams. These are seasonal non-fish bearing streams where surface flow is not present year round.

Wetlands are classified into two broad categories: forested and non-forested. Non-forested are further divided into Type A and Type B wetlands.

- Forested wetlands – Wetlands that have a 30% or more crown closure (see Glossary).
- Non-forested wetlands – Wetlands that have a less than 30% crown closure.
    - Type A wetlands – Are greater than 0.5 acre in size and are associated with at least 0.5 acre of ponded or standing open water present for at least 7 consecutive days between April 1 and October 1.
    - Type B wetlands – All other non-forested wetlands greater than 0.25 acre.

On-site Review for Water Types Statewide

Field observations sometimes indicate that water types depicted on water type maps are incorrect. Landowners may use existing DNR water type maps as a starting point for information as they prepare their FPA for submittal to DNR but must verify water types located within the areas proposed for forest management activities and indicate the correct water types on the FPA. Correct and accurate water typing is critical because when water is typed incorrectly, inadequate riparian protection measures may be applied which may ultimately impact public resources. Water type verification occurs through measurement of the water's physical characteristics as defined in WAC 222-16-031 and 035, or through a protocol (fish) survey (to confirm fish presence/absence) as specified in Forest Practices Board Manual 13. Applicants are encouraged but not required to complete water type classification worksheets or protocol surveys and submit them with their FPA as supporting documentation for the water types indicated on the FPA.

Changes to DNR water type maps can be made when data from field observations indicate the water type on the water type map is incorrect and/or if a stream is found on the ground in a different location than depicted on the map or not at all. To propose a permanent water type change from the water type indicated on the DNR water type map, an individual submits a Water

Type Modification Form to DNR. The Water Type Modification Form goes through a concurrence process which provides opportunity for review by several stakeholder groups before the water type change can be approved.

The compliance monitoring field team observes physical criteria (such as stream width, stream gradient, etc.) to determine if there appears to be differences between water types recorded on FPAs and what is observed on-the-ground. These observations are made on randomly selected stream reaches and wetlands within the FPA areas that have been previously randomly selected for compliance monitoring for other rules that year. The compliance monitoring field team evaluates only the stream reach or wetland within the proposed boundary shown on the FPA, and therefore, the information is not sufficiently comprehensive to determine all water types depending on the length and location of the water within the FPA. Water types can sometimes only be determined by continuing to observe and measure beyond the unit boundary.

The CMP developed a form called the Supplemental Water Information Form (SWIF) that is used specifically for the purpose of recording potential water type discrepancies and other water related discrepancies. When potential inconsistencies are found by the compliance monitoring field team between on-the-ground measurements and observations and what is described in the FPA, a SWIF is completed and the information is reported in the compliance monitoring report. If an FP rule violation occurred because of the water type inaccuracy observed (i.e. the water did not receive enough riparian protection – buffer width and length), the FPA information is sent to the appropriate DNR region for follow up. The intent of using SWIFs is to obtain a sense of the overall magnitude of possible water typing discrepancies on the landscape and the incorrect application of riparian buffers designed to protect aquatic resources. The compliance monitoring field team does not engage in formal water typing (e.g. fish protocol surveys) with the intent of changing water types because that action has a defined process beyond the scope of the compliance review. The burden is on the landowner to ensure that the water types on the FPA have in fact been field validated.

Findings for Water Types Statewide

Table 3 provides the total number of specific water types observed by the compliance monitoring field team and the number of those that were reported on a SWIF. Those recorded on a SWIF are further broken down into: waters correctly classified, under classified, over-classified and indeterminate. The categories are defined as follows:

- SWIF # Waters Correctly Classified – These are waters that were placed on a SWIF because it was thought they might be classified incorrectly, however, it was found that the waters had been classified correctly on the FPA.
- Under-classified – Physical characteristics indicate that the water should have been typed on the FPA and protected on the ground at a higher level of the hierarchical water typing continuum. For example, the FPA depicts a Type Np water on the FPA that is found to actually be a Type F stream.
- Over-classified – Physical characteristics indicate that the water should have been typed on the FPA and could have been protected on the ground at a lower level of the hierarchical water typing continuum. For example, the FPA depicts a Type F water that after observation is actually a Type Np stream.

- Classified indeterminate – waters where the compliance monitoring field team feels they do not have enough information to make a water typing determination. For example, when the compliance monitoring field team visits a site in the wettest part of the year (winter) and cannot determine if the water would flow in the driest part of the year (summer). The compliance monitoring field team cannot determine with certainty if the water is a type Np (perennial) or Ns (seasonal).

Table 3: Water Typing Observation Information

Water Type on FPA	# Waters in Standard Sample	# Waters Recorded on SWIF	SWIF # Waters Correctly Classified	SWIF # Waters Under-Classified	SWIF # Waters Over-Classified	SWIF # Waters Indeterminate
Ns	14	3	0	1	2	0
Np	16	5	1	2	1	1
F or S	84	5	0	3	2	0
Type A	12	4	0	3	1	0
Type B	10	1	0	0	0	1
Forested Wetland	8	0	0	0	0	0
Not Mapped or Type"N"on Hydro data	0	2	1	1	0	0
Total	144	20	2	10	6	2

During 2012, the Compliance Monitoring Program evaluated 144 riparian related prescriptions involving typed water or wetlands. The number of typed waters or wetlands where the compliance monitoring field team found discrepancies was 20 or 13.9% of the total observed. These 20 were reported on SWIFs. The total number of typed waters on FPAs that were under-classified was 10, (6.9%) while the number that was over-classified was 6, (4.2%). Type Np streams were under-classified for 12.5% of the Type Np sample due to the presence of Type F physical characteristics. Type A wetlands were under-classified three times (25% of the sample). The most common cause of over-classification occurred when a stream reach was disconnected (there was no overland flow) from a higher order water – i.e. a true Type Np water (over-classed as a Type F) was disconnected from a Type F water.

3.2 Statewide Summary Table for FP Rule Compliance for RMZs, WMZs and ELZs

Section 3.2 provides a summary table showing overall statewide results for compliance with RMZ and WMZ forest practices rules. The data and findings for each individual prescription are discussed in section 3.3 Western Washington RMZ, section 3.4 Eastern Washington RMZs, and section 3.5 Statewide WMZs below.

Table 4 lists the RMZ, WMZ, and equipment limitation zone (ELZ) prescriptions that were monitored during the 2012 compliance sample.

Table 4: RMZ, WMZ and ELZ Prescriptions Sampled in 2012

Western Washington	Eastern Washington	Statewide
RMZ – No Outer Zone Harvest RMZ – No Inner Zone Harvest RMZ – Option 1–Thinning from Below RMZ – Option 2– Leaving Trees Closest to Water RMZ – Type Np RMZ	RMZ – No Outer Zone Harvest RMZ – No Inner Zone Harvest RMZ – Inner Zone Harvest (combined habitat types) RMZ – Type Np RMZ	WMZ –Wetlands ELZ - Type Ns Activities RMZ – 20-acre exempt parcels

Table 5 shows the status of FP rule compliance for RMZ prescriptions for stream types S, F, Np and Ns (including ELZs), as well as for wetlands. Each prescription has a unique set of timber harvest requirements, and includes the use of a corresponding set of protocols and questions to determine compliance status. Forest Practices rule prescriptions for Type F and N streams can be different for Eastern and Western Washington. Wetland rules are consistent across the state.

The reader should be aware that table 5 only represents the first year of a biennial sample, so confidence intervals in this report may be wide (wider confidence intervals represents less confidence in the value) but are expected to narrow with additional sampling and completion of the analysis for the entire biennium. The small proportion of small forest landowner FPAs in the table reflect the small proportion of total small forest landowner FPAs in the total FPA population that contain the prescriptions assessed.

Table 5: 2012 Compliance with Forest Practices Rules for Riparian and Wetland Harvest Prescriptions

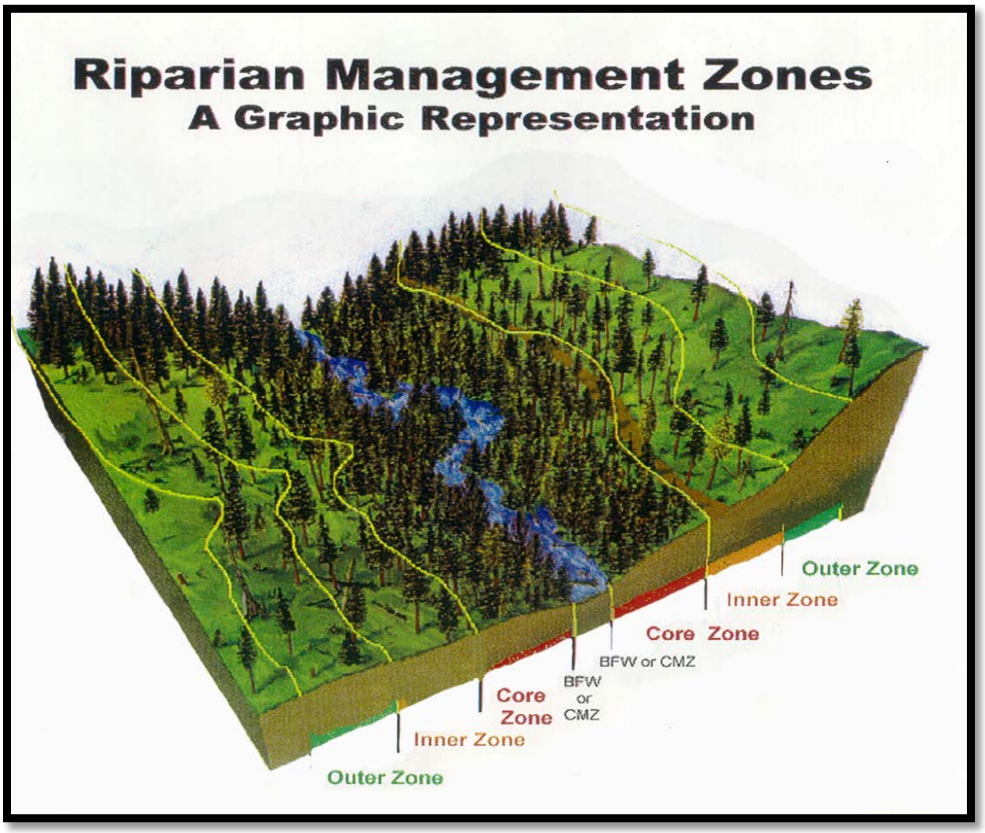
	Status of Compliance	Western Washington					Eastern Washington				Statewide			
		No Inner Zone Harvest	F or S No Outer Zone Harvest	DFC Option 1	DFC Option 2	Np Activities	No Inner Zone Harvest	F or S No Outer Zone Harvest	F or S Inner Zone Harvest	Np Activities	Ns Activities	Type A Wetland	Type B Wetland	Forested Wetland
Small Forest Landowners	# Compliant	2	4	0	0	0	0	0	0	0	1	2	2	1
	# with Deviation	2	0	0	0	0	0	0	0	0	1	3	0	0
	% of Sample Compliant	50%	100%	n/a	n/a	n/a	n/a	n/a	n/a	n/a	50%	40%	100%	100%
	Confidence Interval	(9, 91)	(46, 100)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	(9, 48)	n/a	n/a
	Assessed	4	4	0	0	0	0	0	0	0	2	5	2	1
Industrial Landowners	# Compliant	13	9	8	10	9	11	5	0	4	12	5	8	7
	# with Deviation	7	1	3	6	2	2	1	0	0	0	1	0	0
	% of Sample Compliant	65%	90%	73%	63%	82%	85%	83%	n/a	100%	100%	83%	100%	100%
	Confidence Interval	(42, 83)	(61, 100)	(57, 85)	(38, 83)	(49, 98)	(59, 97)	(44, 99)	n/a	(40, 100)	(74, 100)	(40, 99)	(65, 100)	(60, 100)
	Assessed	20	10	11	16	11	13	6	0	4	12	6	8	7
All Landowners	# Compliant	15	13	8	10	9	11	5	0	4	13	7	10	8
	# with Deviation	9	1	3	6	2	2	1	0	0	1	4	0	0
	% of Sample Compliant	63%	93%	73%	63%	82%	85%	83%	n/a	100%	93%	64%	100%	100%
	Confidence Interval	(42, 80)	(69, 100)	(57, 85)	(38, 83)	(49, 98)	(59, 97)	(44, 99)	n/a	(40, 100)	(66, 100)	(34, 87)	(70, 100)	(64, 100)
	Assessed	24	14	11	16	11	13	6	0	4	14	11	10	8

3.3 Western Washington RMZs and ELZs

Protection measures along typed water in western Washington include protecting channel migration zones; establishing riparian management zones along the full length of fish bearing waters and along a portion of the length of perennial non-fish bearing waters; retaining no-harvest buffers adjacent to sensitive sites and establishing zones where equipment is limited along non-fish bearing waters.

RMZs adjacent to fish-bearing streams include a core zone, inner zone, and outer zone with differing prescriptions delineated in rule for inner and outer zones (see Figure 3). No timber harvest or road construction is allowed in the 50-foot core zone (zone closest to the water) except for the construction and maintenance of road crossings and the creation and use of yarding corridors. The inner zone (middle zone, not including core zone) ranges from 10 feet to 100 feet depending on width of the stream and site class (See Glossary) of the forested stand. Timber harvest of “surplus” trees in the inner zone is only allowed if pre-determined stand requirements are met which are intended to result in a mature riparian forest stand at 140 years of age (called “Desired Future Condition”). Timber harvest is allowed in the outer zone (adjacent to and outside the inner zone) with 20 riparian leave trees per acre retained following harvest.

Figure 3. Type S and F Water Riparian Management Zones



Protection along non-fish bearing waters in western Washington includes RMZs along at least 50% of the length of type Np waters and around sensitive sites and the establishment of equipment limitation zones for both Np and Ns waters. An equipment limitation zone is a 30-foot-wide area where equipment use is limited in order to minimize ground and soil disturbance. The equipment limitation zone protects stream bank integrity and helps minimize sediment delivery to non-fish-bearing waters that could potentially be routed further downstream to fish-bearing waters.

Following is a description by prescription type of forest practices rules that regulate harvest within the RMZ of typed waters in western Washington; on-site review information where informative; and findings from the compliance monitoring field team observations.

3.3.1 Type S and F Waters in W. WA.

Section 3.3.1 addresses Type S and F riparian prescriptions including: no inner zone harvest, no outer zone harvest, DFC Option 1– thinning from below, and DFC Option 2 – leaving trees closest to the water.

On-Site Review for Type S and F Waters in W. WA.

During the compliance monitoring field review, there are questions on the Western Washington Riparian Field Forms that are common to all riparian harvest options for Type S and F waters, including:

- Is there any harvest within the core, inner, and outer zones?
- Is the site class (variable in determining inner zone width) consistent with DNR site class maps?

- Is the stream width (variable in determining inner zone width) the same as stated on the FPA? If not, does it impact the inner zone width?
- Are unstable slopes with the potential to deliver (sediment) bounded out of the harvest unit?

In addition to common questions relevant to all Type S and F water riparian prescriptions, specific western Washington riparian prescription questions are asked on the Western Washington Riparian Field Form that assesses the unique rules directed at individual harvest options.

3.3.1.1 Type S and F Water – Option 1, Thinning from Below in W. WA.

This option is available if desired future condition (DFC) growth modeling results show that there is surplus basal area available which allows for harvest to take place in the inner zone. DFC calculations indicate if a forest stand meets basal area requirements, that is, if the stand is on the trajectory to meet the desired future condition of 325 square feet of basal area per acre at a stand age of 140 years. When DFC calculations indicate that harvest is allowed because the model projects that more basal area is available than is needed to meet the basal area target in FP rule, the smallest diameter trees are allowed to be harvested, followed by the selection harvest of progressively larger trees until the surplus basal area limit has been reached (also referred to as "thinning from below"). This selection process is intended to establish a forest environment where the leave trees in the inner zone can grow larger in a shorter time and meet desired large wood, fish habitat, and water quality functions more quickly. The width of the inner zone and outer zone varies depending upon the bankfull width of the stream and the site class. A minimum of 57 of the largest conifer trees per acre must be left in the inner zone. Twenty conifer trees per acre greater than 12 inches diameter breast height (DBH) must be retained in the outer zone. The leave trees in the outer zone may be dispersed evenly throughout the zone or clumped around sensitive features such as seeps, springs, and forested wetlands.

Findings for Type S and F Water – Option 1, Thinning from Below in W. WA.

Desired Future Condition Option 1 is the most complex Type F prescription to implement in terms of the number of conditions to be met. It occurs relatively rarely in the population of FPAs. The estimated total population statewide is 13. There were 11 FPAs statewide in the 2012 sample with DFC Option 1 chosen as the harvest option. Table 6 below displays the results for Desired Future Condition Option 1.

Table 6: Compliance Ratings for Western Washington Type S and F Water – DFC Option 1, Thinning from Below

RMZ Prescription	Forest Practices Rule Compliance Ratings					
	Compliant Ratings		Deviation Ratings			
	Exceeds	Compliant	Minor	Moderate	Major	Indeterminate
DFC Option 1 (Percent)	0%	73%	18%	0%	9%	0%
DFC Option 1 (Count)	0	8	2	0	1	0

Sample Size = 11

Seventy-three percent of the samples were assessed as compliant for the DFC Option 1 prescription type. Of the eleven sites sampled eight were compliant and three showed deviation from at least one FP rule in the prescription type. Two of the sites with a minor deviation had two less outer zone trees than required. In one case there were outer zone leave trees that did not meet the diameter requirements. In the other, the outer zone count was deficient, but additional inner zone trees were left above

requirements. This could be due to where the inner/outer zone boundary was located. One prescription sample was rated as a major deviation because the inner zone stand composition did not reflect the composition reported. Eight outer zone leave trees were required and six were left, and there were two trees cut in the core zone. In this case, non-compliance appeared to be the result of both layout and operational errors.

3.3.1.2 Type S and F Water – Option 2, Leaving Trees Closest to the Water in W. WA.

This option only applies to RMZs for site class I, II, and III on streams that are less than or equal to ten feet wide and RMZs in site class I and II for streams greater than ten feet wide. For this option, DFC growth modeling results show that there is surplus basal area available which allows for harvest to take place in the inner zone. Trees are selected for harvest starting from the outer-most portion of the inner zone first and then progressively closer to the stream. Twenty conifer trees per acre must be left in the harvested area of the inner zone with a minimum DBH of 12 inches. The width of the inner zone and outer zone varies depending upon the bankfull width of the stream and the site class. For site class I, II, and III on streams less than or equal to 10 feet, there's a 30-foot no-harvest extension beginning at the outer edge of the core zone. For site class I and II on streams greater than 10 feet, there's a 50 foot no-harvest extension beginning at the outer edge of the core zone. Twenty conifer trees per acre greater than 12 inches DBH must be retained after harvest in the outer zone unless a large woody debris in-channel placement strategy is selected. Leave trees in the outer zone may be evenly dispersed throughout the zone or clumped around sensitive features.

Findings for Type S and F Water – Option 2, Leaving Trees Closest to the Water in W. WA

DFC Option 2 harvest is less complex to implement and is chosen more frequently than DFC Option 1. Sixteen DFC Option 2 prescriptions were sampled from an estimated population of 95 FPAs. Table 7 below displays the results for Desired Future Condition Option 2.

Table 7: Compliance Ratings for Western Washington Type S and F Water – DFC Option 2 – Leaving Trees Closest to the Water

RMZ Prescription	Forest Practices Rule Compliance Ratings					
	Compliant Ratings		Deviation Ratings			
	Exceeds	Compliant	Minor	Moderate	Major	Indeterminate
DFC Option 2 (Percent)	0%	62%	19%	13%	0%	6%
DFC Option 2 (Count)	0	10	3	2	0	1

Sample Size = 16

Sixty-three percent of the samples were assessed as compliant for the DFC Option 2 prescription type. Of the 16 sites sampled, 10 were compliant and six showed deviation from at least one FP rule in the prescription type. Three of the samples were rated a minor deviation, one site had a tree harvested in the area of the inner zone closest to the water, and two sites had insufficient outer zone leave trees. One of these sites was also lacking one inner zone tree. Two prescriptions were rated with a moderate deviation because the streams, when measured, were larger (greater than 10 feet wide) than what was reported on the FPA. This resulted in the RMZ width providing insufficient protection.

3.3.1.3 Type S and F Water – No Inner Zone Harvest in W. WA

For this option, DFC results show that existing stands in the combined core and inner zone do not meet stand requirements and, therefore, no inner zone harvest can take place or sometimes the landowner elects not to harvest in the inner zone for operational or other reasons.

Findings for Type S and F Water – No Inner Zone Harvest in W. WA

No inner zone harvest is the most frequently selected harvest strategy along fish bearing water. This harvest strategy occurs on an estimated 162 FPAs in the 2012 population. Table 8 below displays the results for No Inner Zone Harvest.

Table 8: Compliance Ratings for Western Washington Type S and F Water – No Inner Zone Harvest

RMZ Prescription	Forest Practices Rule Compliance Ratings					
	Compliant Ratings		Deviation Ratings			
	Exceeds	Compliant	Minor	Moderate	Major	Indeterminate
No Inner Zone Harvest (Percent)	0	63%	29%	8%	0%	0%
No Inner Zone Harvest (Count)	0	15	7	2	0	0

Sample Size = 24

Sixty-three percent of the samples were assessed as compliant in the no inner zone harvest prescription type. Of the 24 sites sampled 15 sites were compliant while nine sites showed deviation from at least one FP rule in the prescription type. In the seven cases where the prescription was rated as a minor deviation, four received the rating solely for insufficient outer zone tree count with the inner and core zones remaining intact. The other three instances involved some harvest along outer edge areas of the inner zone.

Two sites sampled were rated with a moderate deviation. One was rated moderate because of harvest in the inner zone and only two of nine required outer zone trees were retained. The other sample had too few outer zone leave trees remaining and eight trees of the larger diameter classes harvested from the inner zone.

3.3.1.4 Type S and F Water – No Outer Zone Harvest in W. WA.

In this option, the Forest Practices Application states that no harvest is occurring within any portion of the RMZ. Though this is not a rule, it is an option allowed in the FPA submission where the applicant elects not to enter any portion of the RMZ. The rule which applies is the “No Inner Zone Harvest”. This activity is assessed separately from the No Inner Zone Harvest because the applicant selects a more restrictive prescription. Rule compliance is assessed based on whether the RMZ meets the conditions required under the No Inner Zone Harvest prescription.

Findings for Type S and F Water – No Outer Zone Harvest in W. WA

There were an estimated 54 no outer zone harvests in the 2012 sample.

Table 9: Compliance Ratings for Western Washington Type S and F Water – No Outer Zone Harvest

RMZ Prescription	Forest Practices Rule Compliance Ratings					
	Compliant Ratings		Deviation Ratings			
	Exceeds	Compliant	Minor	Moderate	Major	Indeterminate
No Outer Zone Harvest (Percent)	0	93%	7%	0%	0%	0%
No Outer Zone Harvest (Count)	0	13	1	0	0	0

Sample Size = 14

Ninety-three percent of the samples were assessed as compliant in the no outer zone harvest prescription type. Of the 14 sites sampled, 13 sites were assessed as compliant while one showed deviation from at least one FP rule in the prescription type. The one deviation was rated as minor because eight trees were harvested along the outer edge of the inner zone.

3.3.2 Type Np Water in W. WA

Type Np streams and sensitive sites contribute to the quality of water and fish habitat in downstream Type S and/or F streams. They also provide habitat to some wildlife.

Fifty-foot-wide RMZs are required along portions (and specified locations) of Type Np streams. For example, a 50-foot-wide no harvest RMZ is required where Type Np streams join a Type S or F stream.

The total distance of the 50-foot buffer required along an Np stream varies and depends upon the length of the Type Np stream from the confluence with the Type S or F stream. At least 50% of a Type Np waters' length must be protected by buffers on both sides of the stream (2-sided buffers). If the Type Np Water on the FPA is located more than 500 feet upstream from the confluence of a Type S or F Water and if the Type Np Water is more than 1000 feet in length, then the minimum percent of length of Type Np water to be buffered varies as per the table in WAC 222-30-021(2 (b)(vii).

Sensitive sites associated with Np streams must also be protected with buffers or harvest restrictions. These include headwater springs or the upper most point of perennial flow; the intersection of two or more Type Np waters; perennially saturated side-slope seeps; perennially saturated headwall seeps; and alluvial fans. No harvest is allowed within alluvial fans.

Type Np streams also requires a 30-foot-wide equipment limitation zone (ELZ). Equipment use and other forest practices are specifically limited and mitigation may be required if activities expose the soil on more than 10% of the ELZ length.

On-Site Review for Type Np Waters in W. WA

Questions asked on the Western Washington Riparian Field Form for Np streams differ from Type S and F fish bearing streams. Examples include

- Is there evidence of equipment entry into the 30-foot ELZ? If so, was less than 10% of the soil with the ELZ exposed due to activities?
- Was the appropriate length of 50-foot no-harvest zone left on the given stream segment?

Findings for Type Np Waters in W. WA
Type Np streams were commonly encountered with an estimated 391 western Washington FPAs having one or more Np streams within their harvest boundaries.

Table 10: Compliance Ratings for Western Washington Type Np Water

RMZ Prescription	Forest Practices Rule Compliance Ratings					
	Compliant Ratings		Deviation Ratings			
	Exceeds	Compliant	Minor	Moderate	Major	Indeterminate
Np Water (Percent)	0%	82%	9%	0%	0%	9%
Np Water (Count)	0	9	1	0	0	1

Sample Size = 11

Eighty-two percent of the samples were assessed as compliant for the Np water prescription type. Of the 11 sites sampled, nine were compliant and two showed deviation from at least one FP rule in the prescription type. One sample was rated as a minor deviation because of one tree harvested in the buffer of the uppermost point of perennial flow. The remaining sample was rated as an indeterminate deviation because a portion of the Np stream met Type F physical characteristics.

3.3.3 Type Ns Waters in W. WA

Buffers are not required for Type Ns streams. There is a 30-foot equipment limitation zone (ELZ) and mitigation measures required if more than 10% of the soil in the ELZ is exposed.

Findings for Type Ns Waters in W. WA
Type Ns waters are common, occurring in an estimated 332 FPAs in the western Washington population for the 2012 sample.

Table 11: Compliance Ratings for Western Washington Type Ns Water

RMZ Prescription	Forest Practices Rule Compliance Ratings					
	Compliant Ratings		Deviation Ratings			
	Exceeds	Compliant	Minor	Moderate	Major	Indeterminate
Ns Water (Percent)	0%	90%	0%	0%	0%	10%
Ns Water (Count)	0	9	0	0	0	1

Sample Size = 10

Ninety percent of the samples were assessed as compliant in the Ns water prescription type. The one sample that was rated as an indeterminate deviation had an Ns stream with Type F physical characteristics for gradient and width. The rating was assessed as indeterminate because fish use was not confirmed.

3.4 Eastern Washington RMZs and ELZs

In eastern Washington riparian management is intended to result in stand conditions that vary over time. Management is designed to mimic eastside disturbance (such as wildfire) regimes in a way that protects riparian function conditions and maintains general forest health. Harvest adjacent to a Type S, F or Np stream is based upon the DNR site class map, timber habitat type (see section 3.4.3 below), basal area, and shade requirements needed to protect the stream. Habitat types include Ponderosa Pine, Mixed Conifer, and High Elevation. The no harvest core zone along type S and F waters is 30 feet. Harvest units within the bull trout overlay must leave all available shade within 75 feet of the bankfull width or CMZ, whichever is greater. Np and Ns waters have an equipment limitation zone (ELZ) of 30 feet.

Following is a description by prescription type of forest practices rules that regulate harvest within the RMZ of typed waters in eastern Washington, and on-site review information and findings from compliance monitoring field team observations.

On-Site Review of Timber Harvest Adjacent to Type S and F Waters in E. WA
During field review, there are questions on the Eastern Washington Riparian Field Form that are common to all the riparian harvest options, such as:

- Is there any harvest within the core, inner, and outer zones?
- Is the site class (variable in determining inner zone width) consistent with DNR site class maps?
- Is the stream width (variable in determining inner zone width) the same as stated on the FPA? If not, does it impact the inner zone width?

- Are unstable slopes with the potential to deliver (sediment and debris) bounded out of the harvest unit?

In addition to common questions relevant to all Type S and F water riparian prescriptions, specific eastern Washington riparian prescription questions are asked on the Eastern Washington Riparian Field Form that assesses the unique rules directed at individual harvest options.

3.4.1 Type S and F Water – No Inner Zone Harvest in E. WA

In this option, no harvest occurs in the inner zone because the forest stand does not meet certain basal area requirements based on timber habitat type (see section 3.4.3) or sometimes the landowner elects not to harvest in the inner zone for operational or other reasons. Outer zone leave tree requirements are also based on timber habitat type.

Findings for Type S and F Water – No Inner Zone Harvest in E. WA

No Inner zone harvests are the most common eastern Washington fish bearing water prescription used with an estimated 40 occurrences in the 2012 population.

Table 12: Compliance Ratings for Eastern Washington Type S and F Water – No Inner Zone Harvest

RMZ Prescription	Forest Practices Rule Compliance Ratings					
	Compliant Ratings		Deviation Ratings			
	Exceeds	Compliant	Minor	Moderate	Major	Indeterminate
No Inner Zone Harvest (Percent)	0%	85%	15%	0%	0%	0%
No Inner Zone Harvest (Count)	0	11	2	0	0	0

Sample Size =13

Eighty-five percent of samples were assessed as compliant in the no inner zone prescription type. Of the 13 FPAs sampled 11 were assessed as compliant and two showed deviation from at least one FP rule in the prescription type. Both sites assessed as a deviation were rated as minor and in both cases two or fewer trees were harvested from the inner zone. In one of these cases the applicant marked the RMZ boundary closer to the stream than allowed by rule.

3.4.2 Type S and F Water – No Outer Zone Harvest in E. WA

In this option, the Forest Practices Application states that no harvest is occurring within any portion of the RMZ. Though this is not an FP rule, it is an option allowed in the FPA submission where the applicant elects not to enter any portion of the RMZ. The rule which applies is the “No Inner Zone Harvest”. This activity is assessed separately from the No Inner Zone Harvest because the applicant selects a more restrictive prescription. Rule compliance is assessed based on whether the RMZ meets the conditions required under the No Inner Zone Harvest prescription.

Findings for Type S and F Water – No Outer Zone Harvest in E. WA
"No Outer Zone Harvest" prescriptions occurred on an estimated 17 FPAs in Eastern Washington in 2012.

Table 13: Compliance Ratings for Eastern Washington Type S and F Water – No Outer Zone Harvest

RMZ Prescription	Forest Practices Rule Compliance Ratings					
	Compliant Ratings		Deviation Ratings			
	Exceeds	Compliant	Minor	Moderate	Major	Indeterminate
No Outer Zone Harvest (Percent)	16%	67%	0%	0%	17%	0%
No Outer Zone Harvest (Count)	1	4	0	0	1	0

Sample Size = 6

Eighty-four percent of the samples were assessed as compliant in the no outer zone prescription type. Of the 6 sites sampled, one was rated as exceeds FP rule requirements (16% of the samples) due to a much wider RMZ than required. One of the samples was assessed as a major deviation from FP rule due to a Type F stream that was protected as if it were a type Np stream. The stream reach length was over 2,600 feet with a required two sided buffer. Over 1,000 feet of inner zone on each side was harvested where there should have been no harvest. Additionally, a skid trail was constructed in the inner zone on one side for 1,000 feet.

3.4.3 Type S and F Water – Inner Zone Harvest (All Habitat Types) in E. WA

If a landowner is allowed to harvest within the inner zone (all basal area requirements are met – see below), then the leave tree and minimum basal area per acre requirements are based upon habitat type and site index:

Ponderosa Pine Habitat Type (elevation at or below 2500 feet) – WAC 222-30-022 (1)(b)(i)
In stands with a high basal area in the inner zone (greater than 110 square feet (sq. ft.) per acre for conifer and hardwood trees equal to or greater than 6 inches DBH) harvest is permitted in the inner zone. The harvest must leave at least 50 trees per acre and a minimum leave tree basal area of at least 60 sq. ft. per acre.

In stands with low basal area and high density, thinning is permitted if the basal area of all species is less than 60 square feet per acre and there are more than 100 trees per acre. The thinning must leave a minimum of 100 trees per acre. There are requirements about which type of trees should be left.

Ten dominant or co-dominant trees per acre are required to be left in the outer zone.

Mixed Conifer Habitat Type (elevation from 2501 to 5000 feet) – WAC 222-30-022 (1)(b)(ii)
Harvest is allowed in stands with a high basal area (greater than a certain square feet per acre depending on the site index). Harvest must leave at least 50 trees per acre and a minimum total leave tree basal area.

Thinning is permitted in stands with a low basal area and high density if the basal area of all species is less than the minimum requirements for the site index.

Fifteen dominant or co-dominant trees per acre are required to be left in the outer zone.

High Elevation Habitat Type (elevations above 5000 feet) – WAC 222-30-022 (1)(b)(iii)
Desired Future Condition growth modeling determines if there is surplus basal area available in order for harvest to take place in the inner zone. Leave tree requirements are the same as those for Type S or F Waters in Western Washington. Twenty dominant or co-dominant trees per acre are required to be left in the outer zone.

On-Site Review for Type S and F Water – Inner Zone Harvest (All Habitat Types) in E. WA
The following describes how assessments are made by the compliance monitoring field team:

- In stands with high basal area, the compliance monitoring field team evaluates whether the harvest left the required number and size of trees per acre and minimum basal area per acre appropriate for the forest habitat type and site index.
- In stands with low basal area, the compliance monitoring field team assesses whether the minimum number of trees per acre are left standing, based on the forest habitat type.
- The outer zone is also assessed for the correct number of dominant and co-dominant trees per acre according to the forest habitat type.
- Stream adjacent parallel roads in the inner zone were also evaluated for compliance with the rules. See Eastern Washington Compliance Monitoring Field Form #6 for details on the information collected when a stream adjacent parallel road was present in the inner zone.

Findings for Type S and F Water – Inner Zone Harvest (All Habitat Types) in E. WA
No occurrences of Inner zone harvest strategies occurred in the 2012 eastern Washington sample. In a typical sample year it is common for very few (1-2) to occur.

3.4.4 Type Np Water in E. WA.

Type Np streams require a 50-foot-wide RMZ which includes a 30-foot-wide equipment limitation zone. Harvest may be allowed within the 50-foot buffer if certain basal area requirements and tree counts are met. Two harvest strategies are available:

- Partial Cut Strategy: This strategy is a thinning of the RMZ and has thresholds for residual basal area and tree counts.
- Clearcut Strategy: This strategy has no-harvest areas which must meet the basal area and tree count thresholds while allowing certain parts of the RMZ to be clearcut. The landowner designates a no harvest buffer along the stream reach in the harvest unit that is equal in total length to the clearcut portion of the stream reach in the harvest unit, and meets the upper end of basal area requirements for each respective timber habitat type. The streamside boundary of all clearcuts must not exceed in total 30% of the length of the stream reach in the harvest unit and not exceed 300 continuous feet in length. The clearcut boundary must not be located within 500 feet of the intersection of Type S or F waters and not occur within 50 feet of sensitive sites.

On-Site Review for Type Np Water in E. WA
The harvest strategy within the RMZ is confirmed: partial cut or clearcut; tree count and basal area thresholds are met; and the required leave trees retained. For the clearcut strategy, the clearcut RMZ length is determined, along with its distance from all Type F or S waters and sensitive sites.

The review also includes evaluation to determine if equipment entered the 30-foot ELZ and if so, what percent of soil exposure occurred as a result. If more than 10% of the soil is disturbed, the compliance monitoring field team assesses whether mitigation measures for the disturbance are completed.

Findings for Type Np Water in E. WA
In 2012, Eastern Washington Np waters are estimated to occur on 180 FPAs.

Table 14: Compliance Ratings for Eastern Washington Type Np Water

RMZ Prescription	Forest Practices Rule Compliance Ratings					
	Compliant Ratings		Deviation Ratings			
	Exceeds	Compliant	Minor	Moderate	Major	Indeterminate
Np Water (Percent)	25%	75%	0%	0%	0%	0%
Np Water (Count)	1	3	0	0	0	0

Sample Size = 4

One-hundred percent of the samples were assessed as compliant for the Np samples with 25 percent rated as exceeds due to a buffer of over 100 feet (twice the required width), around an Np Spring.

3.4.5 Type Ns Water E. WA

Buffers are not required for type Ns streams. There is a 30-foot-wide equipment limitation zone (ELZ) and mitigation measures required if more than 10% of the soil within the ELZ is exposed.

Findings for Type Ns Water E. WA

Table 15: Compliance Ratings for Eastern Washington Type Ns Water

RMZ Prescription	Forest Practices Rule Compliance Ratings					
	Compliant Ratings		Deviation Ratings			
	Exceeds	Compliant	Minor	Moderate	Major	Indeterminate
Ns (Percent)	0%	100%	0%	0%	0%	0%
Ns (Count)	0	4	0	0	0	0

Sample Size = 4

One-hundred percent of the samples were assessed as compliant for the Ns stream prescription type.

3.5 Statewide WMZs

Forest Practices wetland rules are the same for Western and Eastern Washington. Wetland Management Zones have variable widths based on the size and type of wetland. Type A Wetlands greater than 5 acres have a minimum 50-foot WMZ width. Type A and Type B Wetlands 0.5 to 5 acres have a minimum 25-foot width WMZ, while Type B Wetlands less than 0.5 acre and Forested Wetlands have no WMZ required. There are leave trees required (by size and number) within the WMZ. There are also restrictions regarding the maximum width of openings created by harvesting within the WMZ. In addition, ground based harvesting systems shall not be used within the minimum WMZ width without written approval from DNR.

Following is a description by prescription type of forest practices rules that regulate wetlands statewide; on-site review information where informative; and findings from the compliance monitoring field team observations.

On-Site Review for Wetlands Statewide

Protection measures for wetlands depend upon the size and type of wetland. The information collected by the compliance monitoring field team on-site varies depending upon the type of wetland. Some of the questions answered by the team are applicable to all wetlands:

- Were the wetlands typed and sized appropriately on the ground, and consistent with the FPA?
- Is the variable buffer width appropriate relative to the WMZ table in the rules?
- If operations were conducted within the WMZ, were the openings less than 100-feet wide?
- If operations were conducted within the WMZ, were the openings no closer than 200-feet from each other?

In addition, for Type A and Type B wetlands, the compliance monitoring field team evaluates the following:

- Leave trees in the WMZ for species, number, and size;
- Approval by DNR for use of ground based harvesting systems within the minimum WMZ and for any timber that was felled into or cable yarded across the wetland;
- Protections applied when a WMZ overlaps an RMZ; and
- For particular leave tree requirements if the harvest within the WMZ is greater than or less than 10%.

If harvest occurs within a forested wetland, the compliance monitoring field team determines whether the harvest method is limited to low impact harvest or cable systems; and whether the wetland boundaries (if greater than 3 acres within the harvest unit) are delineated correctly and shown on the activity map by the applicant.

3.5.1 Type A Wetland Management Zones Statewide

Findings for Type A Wetland Management Zones Statewide
Type A wetlands are estimated to occur on 54 FPAs statewide in the 2012 population. Findings are displayed in Table 16.

Table 16: Compliance Ratings for Statewide Type A Wetland Management Zones

WMZ Prescription	Forest Practices Rule Compliance Ratings					
	Compliant Ratings		Deviation Ratings			
	Exceeds	Compliant	Minor	Moderate	Major	Indeterminate
Type A (Percent)	0%	64%	18%	9%	0%	9%
Type A (Count)	0	7	2	1	0	1

Sample Size = 11

Sixty-four percent of the samples were assessed as compliant for the Type A WMZs prescription. Of the 11 sites sampled, seven were compliant and four showed deviation from at least one FP rule in the prescription type. Two were rated with a minor deviation, one for accessibility to fish, which changed the WMZ to an RMZ for a portion of the wetland and the other had three too many trees harvested. One site was rated with a moderate deviation because trees were missing in all size classes. This was a known FP violation with a note attached that said the violation was found and mitigation enforced prior to its inclusion in the sample. The fourth sample with deviation was rated indeterminate because it displayed Type F stream physical characteristics but it was unknown if fish were present.

3.5.2 Type B Wetland Management Zones Statewide

Findings for Type B Wetland Management Zones Statewide
There were approximately 105 FPAs statewide that contained Type B wetlands in the 2012 sample population.

Table 17: Compliance Ratings for Statewide Type B Wetland Management Zones

WMZ Prescription	Forest Practices Rule Compliance Ratings					
	Compliant Ratings		Deviation Ratings			
	Exceeds	Compliant	Minor	Moderate	Major	Indeterminate
Type B (Percent)	0%	100%	0%	0%	0%	0%
Type B (Count)	0	10	0	0	0	0

Sample Size = 10

One-hundred percent of the sites were assessed as compliant for Type B wetlands.

3.5.3 Forested Wetland Management Zones Statewide

Findings for Forested Wetland Management Zones Statewide
There were approximately 118 FPAs statewide that contained forested wetlands in the 2012 sample population. There are no leave tree requirements for forested wetlands.

Table 18: Compliance Ratings for Statewide Forested Wetland Management Zones

WMZ Prescription	Forest Practices Rule Compliance Ratings					
	Compliant Ratings		Deviation Ratings			
	Exceeds	Compliant	Minor	Moderate	Major	Indeterminate
Forested (Percent)	0%	100%	0%	0%	0%	0%
Forested (Count)	0	8	0	0	0	0

Sample Size = 8

One-hundred percent of the sites were assessed as compliant for forested wetlands.

3.6 Emphasis Sample

There was only one riparian prescription type chosen to be sampled as an Emphasis Sample in 2012 – riparian management zones (RMZ) for exempt 20-acre parcels. This RMZ exempt 20-acre parcel prescription was also selected as an Emphasis Sample in 2008, which allowed for a comparison to be made in this report between the two sample years.

FP rules for RMZs for exempt 20-acre parcels
Highlights for FP rules in western and eastern Washington for RMZ exempt 20-acre parcels are listed below.

S and F streams Western Washington
In Western Washington, the RMZ boundary is determined by tree count, shade requirements, and physical features of the landscape and the RMZ requirements include:

- Shade must be maintained as required by WAC 222-30-040,
- The riparian buffer width cannot be less than 29 feet,
- The width is expanded where necessary to include wetlands or ponds adjacent to the stream,
- Leave tree requirements include: an RMZ maximum width, minimum size of leave trees, and ratio of conifer to deciduous trees depending upon the width of the Type S or F water and the composition of the stream bed (gravel/cobble vs. boulder/bedrock).

S and F streams Eastern Washington:

- Maintain sufficient shade as required by WAC 222-30-040,

- 50% or more of the trees shall be live and undamaged on completion of harvest and randomly distributed where feasible,
- RMZ width is based on the adjacent harvest type. If the adjacent unit harvest type is "partial cutting", then the RMZ width is a minimum of 35 feet to a maximum of 58 feet on each side of the stream. For clearcut harvesting, the RMZ averages 58 feet in width with a minimum width of 35 feet and a maximum width of 345 feet on each side of the stream.
- RMZ leave tree requirements include the need to leave all wildlife reserve trees and all trees 12 inches or less. There are size, number, and species requirements (conifer or deciduous) for leave trees and minimum leave tree requirements based upon stream bed composition (boulder/bedrock or gravel/cobble).

Np Streams (Statewide):
Leave trees are left along Type Np waters as necessary to protect public resources. At least 29 conifer or deciduous trees (6 inches in DBH or larger) are left on each side of every 1,000 feet of stream length within 29' of the stream where necessary.

On-Site Review for Statewide RMZs for exempt 20-acre parcels
In order to determine compliance for RMZ exempt 20-acre parcels, the compliance monitoring field team uses the Riparian Management Zones for Exempt 20-acre Parcels Field Form for Western Washington or the Riparian Management Zones for Exempt 20-acre Parcels Field Form for Eastern Washington to record information on-site. Examples of questions asked on the forms include:

Type S and F Western Washington
- Did the applicant harvest within the maximum RMZ widths? If so, did the landowner leave the required # of trees/1000 feet each side?
- If (there was) harvest in the RMZ did the landowner avoid disturbing brush and live trees and stumps and root systems embedded in the bank and did they leave high stumps to prevent felled and bucked timber from entering the water?
- Did the landowner leave an average of 5 undisturbed and uncut wildlife trees per acre in the RMZ at a conifer to deciduous ratio of 1:1 equal to the largest existing tree of those species?

Type S and F Eastern Washington
- Upon completion of harvest, were 50% or more of the leave trees live and undamaged?
- If 10% or more of the harvest unit lies within any combination of an RMZ of a Type S, F or WMZ, did the applicant leave not less than 50% of the trees required in the rule?

Type Np (Statewide)
- Leave at least 29 conifer or deciduous trees, 6 inches or larger DBH, on each side of every 1000 feet of stream length within 29 feet of the stream?

Findings for RMZ Exempt 20-acre Parcels Statewide

Table 19: Compliance Ratings for Statewide Emphasis Sample RMZ Exempt 20-Acre Parcels

RMZ Prescription	Forest Practices Rule Compliance Ratings					
	Compliant Ratings		Deviation Ratings			
	Exceeds	Compliant	Minor	Moderate	Major	Indeterminate
20-acre exempt Harvest (Percent)	0%	57%	14%	14%	11%	4%
20-acre exempt Harvest (Count)	0	16	4	4	3	1

Sample Size = 28

The 2012 emphasis sample for RMZ exempt 20-acre parcels is a census of the population because it included all completed RMZ exempt 20 acre parcel FPAs in the population. Fifty-seven percent of the samples were assessed as compliant. Of the 28 sites, 16 were compliant and 12 showed deviation from at least one FP rule in the prescription type. The samples assessed as a deviation included twelve RMZs. In eight of the 12 RMZs, the applicant cut too many trees. Two of the RMZs had stream widths reported on the FPA as less than 5 feet, when they were actually greater than 5 feet wide. This caused the stream to receive less protection than required in rule. In one sample the landowner needed 3 additional wildlife trees.

Statistically speaking, the 2012 samples assessed as compliant (57%) is not significantly different from the 2008 findings in which 62% of samples were assessed as compliant. This indicates that the compliance rating has not changed.

4. Forest Practices Rule Compliance for Roads and Haul Routes

This section of the report provides rule and on-site review descriptions, and compliance monitoring findings regarding the standard sample for roads and haul routes statewide.

Roads sampling follows the same design as riparian sampling but Haul Route sampling is designed differently. Haul route sampling assesses each 0.1 mile segment of forest road for correct design, construction or maintenance of roads to protect typed waters from sediment delivery. This strategy allows for determining the rate of compliance for the entire haul route of the FPA.

Findings are limited in this report (and all annual reports) because sample sizes are smaller, representing approximately half of the entire biennial sample. Caution must be taken when attempting to draw meaningful conclusions from the findings provided in the annual report. The data and findings shown below may or may not be an indicator for upcoming findings that will be provided when both the 2012 and 2013 field season data are combined and reported in the 2012/2013 biennial report scheduled for next year. The CMP is offering the following data as a status update of CMP sampling.

Introduction:
A well-designed, located, constructed, and maintained system of forest roads is essential to both forest management and protection of public resources. Washington State FP rules – including those for road construction, maintenance and abandonment, and "best management practices" – are some of the most, if not the most, stringent in the country. The FP rules are designed to help ensure that forest roads are constructed, maintained, and abandoned to:

- Provide for fish passage at all life stages,
- Prevent mass wasting,
- Limit delivery of sediment and surface runoff to all typed waters,
- Avoid capture and redirection of surface or ground water,
- Divert road runoff to the forest floor,
- Provide for the passage of some woody debris,
- Protect stream bank stability,
- Minimize construction of new roads, and
- Assure no net loss of wetland function.

Forest practices rules accomplish these goals through ensuring the proper location, design, construction, maintenance and abandonment of forest roads, landings, and stream crossings.

The Compliance Monitoring Program collects data annually on sites where there has been:

- Road construction,
- Landing construction,
- Type N stream road crossing construction, including fords,
- Road abandonment, and
- Haul Routes (forest roads used to truck timber to market).

The following section describes the forest practices rules that regulate statewide road construction, landing construction, type N stream road crossing construction, road abandonment and haul routes, and provides an on-site review description and the compliance monitoring field team findings.

FP Rules for Roads and Haul Routes Statewide

FP rules for road construction, landing construction, Type N stream road crossing, road abandonment and haul routes are explained below.

Forest Road Construction:

Road construction is composed of three components: road location, road design, and actual construction. The road rules require specific standards for road location, design, and construction which are reflected in the questions found in the compliance monitoring Roads Field Form (see on-site review section below).

1) Road Location: Forest practices rules require that roads are located to fit the topography to minimize alteration of natural features (WAC 222-24-020). Examples of FP rule requirements related to road location are the requirement that the applicant minimize the number of stream crossings and not locate roads in bogs or within natural drainage channels (except for crossings).
2) Road Design: Forest practices rules include road design standards which address construction techniques and water management (WAC 222-24-020). For example, new road construction on side slopes exceeding 60% which have the potential to deliver sediment to any typed water or wetland need to utilize full bench construction techniques (WAC 222-24-020(8)).
3) Road Construction: Road construction requirements focus on maintaining stable road prisms and water crossing structures, and on minimizing sediment delivery to surface waters and wetlands (WAC 222-24-030). For example, road construction requires that erodible soil disturbed during road construction needs to be located where it could not reasonably be expected to enter the stream network or be seeded with non-invasive plant species.

Landing location and construction:
Landings are subject to several FP rules. They must not be located within specific areas such as natural drainage channels, RMZs, or WMZs. Landings must be constructed so that they are sloped to minimize accumulation of water on the landing. Excavation material shall not be sidecast where there is high potential for material to enter wetland management zones or within the bankfull width of any stream or the 100-year flood level of any typed water. (WAC 222-24-035).

Type N stream crossings:
Installation, maintenance, and removal of bridges, culverts, and temporary water crossings are subject to several FP rules. For example, culvert placement must be designed so that the alignment and slope of the culvert parallels the natural flow of the stream and it does not cause scouring of the streambed and erosion of the stream banks in the vicinity of the project. Additionally, bridges must not constrict clearly defined channels and temporary water crossings must be constructed to facilitate abandonment (WAC 222-24-040).

Road Abandonment:
Landowners have the option to abandon forest roads, with the exception that in some watersheds landowners are required to abandon roads to keep the road ratio at a certain level. When a landowner chooses to abandon a forest road, specific standards delineated in the FP rules and Board Manual Section 3 must be followed. For example, abandoned roads must be out-sloped, water barred, or otherwise left in a condition suitable to control erosion and maintain water movement within wetlands and natural drainages. An abandoned road must be blocked so that four-wheeled highway vehicles cannot pass the point of closure at the time of abandonment and water crossing structures must be removed (WAC 222-24-052 (3)).

Haul Routes:
FP rule states that roads that are currently used or proposed to be used for timber hauling must be maintained in a condition that prevents potential or actual damage to public resources (WAC 222-24-051 (12)). The compliance monitoring field team observes and records observations for haul routes regarding level of sediment delivery.

On-site Review for Roads and Haul Routes Statewide
In order to determine road compliance, the compliance monitoring field team visits FPA units with forest road construction, landing construction, Type N stream road crossings, abandoned roads and haul routes. The compliance monitoring field team uses the Roads Field Form and the Haul Route Field Form to record information on-site. The data recorded on the Roads Field Form and the Haul Route Field Form help the compliance monitoring field team determine road compliance on each FPA sampled.

Roads Field Form:
The compliance monitoring field team uses the Roads Field Form to record data observed for forest road construction, forest road landing construction, Type N stream road crossings, and abandoned roads. The initial series of questions on the Roads Field Form assess road surface conditions, drainage structure placement and stabilization, routing of drainage water to the forest floor and potential delivery of sidecast. Stream crossing questions assess stream crossing placement, frequency, culvert sizing, positioning and stabilization. Other questions address wetland crossings, road location, wetland replacement, abandonment and stabilization of temporary roads, road abandonment, and proper construction and drainage for forest road landings.

Following are examples of questions found on the Roads Field Form:

- Road location: "Does new road construction minimize stream crossings?" WAC 222-24-020(5).
- Road design: "Where the potential for sediment delivery existed, was full bench construction utilized for roads built on slopes greater than 60%?" WAC 222-24-020(8).
- Road construction: "Were erodible soils disturbed during construction stabilized to prevent the potential to deliver to typed waters?" WAC 222-24-030(4).
- Road landing location and construction: "Was the landing sloped to minimize accumulation of water on the landing?" WAC 222-24-035 (Western WA only).
- Type N stream crossings: "Are the alignment and slope of all culverts on grade with the natural streambed? WAC 222-24-040(2)(3)(4)(5).
- Road Abandonment: "Was the road blocked so that four-wheel highway vehicles cannot pass the point of closure at the time of abandonment?" WAC 222-24-052.

Haul Route Field Form:
The compliance monitoring field team uses the Haul Route Field Form to assess haul routes. The sampling method provides information to report the proportion of compliance/deviance, the level of sediment delivery (table 20), and the cause of the noncompliance (table 21).

Table 20: describes the five levels of sediment delivery: No delivery, De minimus, Low, Medium, and High used by the compliance monitoring field team for rating levels of sediment delivery as well as one decision type (No consensus).

Table 20: Haul Route Sediment Delivery Level Categories

Delivery Level	Delivery Level Description
No Delivery	Complete disconnection of sediment delivery to typed water. Considered compliant.
De minimus	Overland flow from roads reaches typed waters, but sediment delivery is indeterminable from background levels of turbidity. Considered compliant.
Low	Low chronic or temporary delivery. Effects are observable at the site of entry (distance downstream less than one channel width) only, and not expected to magnify over time given the existing activity.
Medium	Measurable but non-critical levels of delivery. Visual plume at the reach scale.
High	Extensive or critical levels of delivery. Substantial violations of turbidity criteria or significant visual plumes that occupy the channel and goes beyond the reach scale (for example, around multiple bends in a stream).
No Consensus	The observers do not agree on the classification. Comments are essential to determine the scope of the difference, recording each observer's classification and the basis of disagreement.

It is helpful, to determine, to the extent possible, causes for sediment delivery. The compliance monitoring field team observes and records both primary and secondary causes of sediment delivery. Table 21 provides descriptions of potential sediment delivery causes.

Table 21: Potential Causes of Sediment Delivery

Potential Causes of Sediment Delivery	Cause Description
Faulty cross drainage	Inadequate frequency of or non-functioning drainage structures that carry road prism runoff or seepage, allowing sediment delivery to typed water.
Inadequate water crossing structures	Absence of or non-functioning structures designed to pass typed water across a forest road resulting in sediment delivery.
Obstructed or bermed ditch line	Features of the road surface or ditch that divert water normally serviced by the ditch causing sedimentation of typed water.
Intercepted water	Water intercepted by road features and diverted to a channel other than its channel of origin prior to the road construction.
Contaminated ditchwater	Ditchwater containing suspended sediment that flows into typed water.
Ruts / inadequate crown	Perturbations of the road surface contributing sediments to runoff reaching typed water.
Driving in ditch line	Vehicular disturbance of stabilized ditches resulting in sediment reaching typed water.
Haul on native surface or inadequate rock	Road haul on a running surface containing fine particles that are captured by runoff and contributed as sediment to typed water.
Water channeled to eroded/failing slopes	Water flow or runoff across unstabilized road features that contributes sediment to typed water.
Road fill failure	Sediment resulting from the effects of gravity on the fill (slumps, raveling, etc.) being deposited in or carried by runoff to typed water.
Cut slope failure	Sediment resulting from the effects of gravity on the cut slope (slumps, raveling, etc.) being carried by ditch flow to typed water.

Findings for Roads and Haul Routes Statewide

This section summarizes data from both the Roads Field Forms and Haul Route Field Forms.

Roads Findings

Road construction or abandonment occurred on an estimated 633 FPAs in the 2012 sample. Table 22 provides statewide compliance information for roads activities (not including haul routes) broken down by landowner type.

Table 22: FP Rule Compliance for 2012 Road Activities

Statewide Road Activities for 2012		
	Status of Compliance	**Road Activities Rule Compliance**
Small Forest Land-owners	# Compliant	3
	# with Deviation	0
	% Samples Compliant	100%
	95% Confidence Interval	(30,100)
	Activity Totals	3
Industrial Land-owners	# Compliant	14
	# with Deviation	0
	% Samples Compliant	100%
	95% Confidence Interval	*CI (77, 100)
	Activity Totals	14
All Land-owner Types	# Compliant	17
	# with Deviation	0
	% Samples Compliant	100%
	95% Confidence Interval	CI (81, 100)
	Grand Totals	17

*CI is confidence interval at the 95% confidence level.

In 2012, Road construction and abandonment activities were assessed as compliant on all 16 sites sampled.

Haul Route Findings

The haul route sample included an inspection of haul routes along forest roads from the farthest points in the FPA to public access roads. In each sample, the entire road was observed if it was less than five miles long. If the entire road was over five miles, 5 one-half mile long road segments were observed. Within each half mile, every 0.1 mile segment was recorded as to its actual or potential delivery of sediment to typed water and the primary and secondary causes for the delivery (see Table 21) were also recorded. The compliance monitoring field team recorded compliance information for haul routes in general and also specifically for haul routes categorized by side slope less than or greater than 60%. The side slope percent data provide information needed to fulfill requirements for Clean Water Act assurances (For more information see: *2009 Clean Water Act Assurances Review of Washington's Forest Practices Program*). For the calculation method see appendix B – ratio proportions.

Table 23 summarizes the delivery level and compliance rates for overall haul route compliance.

Table 23: Haul Route Compliance Summary

Compliant		Deviation		
87% (78,97)CI*		13% (2.9,22)CI		
No Delivery	**De minimus**	**Low**	**Medium**	**High**
61% (48,73)CI	27% (15,39)CI	12% (2.2,21)CI	.82% (0, 2.2)CI	.16% (0, 0.43)CI

*CI is confidence interval at the 95% confidence level.

Table 24 summarizes the primary and secondary causes for delivery of sediment along haul routes observed.

Table 24: Percent of Haul Route Deviation by Cause

Primary Cause	Percent of deviation with this primary cause
Inadequate water crossing structures	23.4%*
Contaminated ditchwater	18.2%
Other (describe in comments)	6.5%
Faulty cross drainage	33.8%
Haul on native surface or inadequate rock	5.2%
Road fill failure	6.5%
Sediment from stream adjacent parallel road	6.4%

na = not applicable
*Over 60% of inadequate water crossings also exhibited ruts or inadequate crowns that contributed to sediment delivery.

Tables 25 and 26 summarize haul route compliance by percent side-slope categories for haul route miles and by percent.

Table 25: Haul Route Miles by Side Slope Category

Slope Category	No Delivery	De minimus	Compliant	Low	Medium	High	Deviation	Grand Total
Slope <60%	36.8	16.2	53	7.1		0.1	7.2	60.2
Slope >60%			0		0.5		0.5	0.5
Grand Total	36.8	16.2		7.1	0.5	0.1		60.7

Table 26: Haul Route Percent Compliance by Side Slope Category

Slope Category	No Delivery	De minimus	Compliant	Low	Medium	High	Deviation
slope<60%	61.1%	26.9%	88.0%	11.8%	0.0%	0.2%	12.0%
slope>60%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	100.0%

The overall 2012 haul route compliance rate of 87% appears lower than the 2011 rate of 96%; however, statistically they are considered to be the same. 2011 was the first season of the haul route prescription type sample.

Table 24 shows that inadequate crossing structures for typed water (water crossings) and faulty relief drainage crossings accounted for 57% of the noncompliance. For efficiency reasons, haul routes were observed on FPAs which had been selected for the harvest prescription sample. Since this is not an independent selection, there is some possibility of bias.

5. Forest Practices Application Compliance

Section 5.0 of the report addresses compliance with the Forest Practice Application (FPA). The results for FPA compliance are displayed in Table 27.

Overall FPA compliance generally mirrors FP Rule compliance on individual FPAs; however, occasionally one may be compliant while the other is not. When the prescription deviates from the FP rules but is compliant with the FPA there are typically mistakes in the layout and/or approval process. When the FPA is compliant with FP rules but deviates from the FPA, typically the landowner proposed activities that were more conservative than what was implemented.

Table 5: 2012 Compliance with Forest Practices Rules for Riparian and Wetland Harvest Prescriptions

	Status of Compliance	Western Washington					Eastern Washington				Statewide			
		No Inner Zone Harvest	F or S No Outer Zone Harvest	DFC Option 1	DFC Option 2	Np Activities	No Inner Zone Harvest	F or S No Outer Zone Harvest	F or S Inner Zone Harvest	Np Activities	Ns Activities	Type A Wetland	Type B Wetland	Forested Wetland
Small Forest Landowners	# Compliant	2	4	0	0	0	0	0	0	0	1	2	2	1
	# with Deviation	2	0	0	0	0	0	0	0	0	1	3	0	0
	% of Sample Compliant	50%	100%	n/a	n/a	n/a	n/a	n/a	n/a	n/a	50%	40%	100%	100%
	Confidence Interval	(9, 91)	(46, 100)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	(9, 48)	n/a	n/a
	Assessed	4	4	0	0	0	0	0	0	0	2	5	2	1
Industrial Landowners	# Compliant	13	9	8	10	9	11	5	0	4	12	5	8	7
	# with Deviation	7	1	3	6	2	2	1	0	0	0	1	0	0
	% of Sample Compliant	65%	90%	73%	63%	82%	85%	83%	n/a	100%	100%	83%	100%	100%
	Confidence Interval	(42, 83)	(61, 100)	(57, 85)	(38, 83)	(49, 98)	(59, 97)	(44, 99)	n/a	(40, 100)	(74, 100)	(40, 99)	(65, 100)	(60, 100)
	Assessed	20	10	11	16	11	13	6	0	4	12	6	8	7
All Landowners	# Compliant	15	13	8	10	9	11	5	0	4	13	7	10	8
	# with Deviation	9	1	3	6	2	2	1	0	0	1	4	0	0
	% of Sample Compliant	63%	93%	73%	63%	82%	85%	83%	n/a	100%	93%	64%	100%	100%
	Confidence Interval	(42, 80)	(69, 100)	(57, 85)	(38, 83)	(49, 98)	(59, 97)	(44, 99)	n/a	(40, 100)	(66, 100)	(34, 87)	(70, 100)	(64, 100)
	Assessed	24	14	11	16	11	13	6	0	4	14	11	10	8

Table 28: Comparison between FPA and Rule Compliance Assessments by Count

	RMZ Prescription	Total	FPA & Rule the Same	Deviation from FPA /Rule Compliant	FPA Compliant / Deviation from Rule	Deviation from FPA /Rule Indeterminate	FPA Compliant / Rule Indeterminate
Statewide	RMZ - Type Ns Prescriptions	**14**	**13**	**1**	**0**	**0**	**0**
	RMZ - Type Np Prescriptions	**16**	**10**	**4**	**1**	**0**	**1**
	WMZ -Type A Wetlands	**12**	**9**	**0**	**2**	**0**	**1**
	WMZ-Type B Wetlands	**10**	**10**	**0**	**0**	**0**	**0**
	WMZ-Type Forested Wetlands	**8**	**8**	**0**	**0**	**0**	**0**
Western Washington	RMZ - Type F or S No Outer Zone Harvest	**15**	**12**	**3**	**0**	**0**	**0**
	RMZ - Type F or S No Inner Zone Harvest	**24**	**23**	**0**	**1**	**0**	**0**
	RMZ - Type F or S Desired Future Condition Option 1	**11**	**11**	**0**	**0**	**0**	**0**
	RMZ - Type F or S Desired Future Condition Option 2	**16**	**14**	**0**	**2**	**0**	**0**
Eastern Washington	RMZ - Type F or S No Outer Zone Harvest	**6**	**6**	**0**	**0**	**0**	**0**
	RMZ - Type F or S No Inner Zone Harvest	**13**	**13**	**0**	**0**	**0**	**0**
	RMZ - Type F or S Inner Zone Harvest	**0**	**0**	**0**	**0**	**0**	**0**

Findings for FPA/FP Rule Compliance Differences

Differences between FPA compliance and FP rule compliance are few. Differences were found in the statewide Np Water, W. WA. No Outer Zone Harvest, W. Washington DFC Option 2, and statewide Type A Wetlands prescriptions.

- Statewide Type Np prescription – This prescription had the most frequently observed difference between Rule and FPA assessments. The majority of the difference occurred as a deviation from the FPA/Rule Compliant. Landowners were in compliance with the FP rule; however, landowners had stated on the FPA that they were going to leave more buffer along the stream than they actually did upon completion of harvest.

- W. WA. No Outer Zone harvest prescription – The landowner was in compliance with the rules. The RMZ may have had some harvest in the outer zone but tree retention patterns still met the No Inner Zone harvest rules.

- W. WA. DFC Option 2 prescription – There was one instance where the buffer was compliant with the FPA but the compliance monitoring field team found that the stream was over 10 feet wide while the landowner recorded the stream as less than 10 feet wide on the FPA. This resulted in incorrect protections being applied based on the incorrect stream size on the FPA. Therefore, the sample was assessed as a deviation from the FP rules. For the second DFC Option 2, the compliance monitoring field team found that the RMZ was longer than was stated on the FPA.

- Statewide Type A Wetlands prescription – In all three cases of FPA/FP rule difference, Type F physical characteristics or fish were observed on the feature.

- Indeterminate – The two indeterminate calls for an Np and a Type A wetland resulted from undetermined connectivity of water and Type A wetland because of possible physical characteristics of a Type F stream.

6. Report Discussion

Discussion regarding results in this annual report is limited because data collected is only for one year of a two year biennial sample. Next year a biennial report will be written that uses combined data from both the 2012 and 2013 field seasons that will provide final biennial results, discussion and conclusions. Section 6 includes discussion on riparian and wetland proportioned compliance; final results for the Emphasis Sample; RMZ exempt 20-acre parcels; findings for the haul route prescription; a statement on interim riparian and wetland findings; and CMP challenges.

Riparian and Wetland Compliance Proportioned Across the Population

Tables that describe 2012 riparian and wetland findings are located in sections 3.2, 3.3, 3.4, 3.5, and 3.6 for individual prescription types. Section 3 also provides estimates of the population sizes for each prescription type. The sampling methodology employed provides desired confidence intervals for a biennial sample but does not support an unbiased way to combine rates and weight by their proportion in the population. Therefore CMP cannot offer for example an overall compliance rate for fish bearing streams. However, to gain a qualitative understanding of the proportion of compliance across RMZ and WMZ prescription types, Table 29 provides the riparian prescription types in decreasing order of population size and their individual compliance rates.

Table 29 –Estimated Population Sizes and Associated FP Rule Compliance Percent

Prescription Type	Estimated Population of FPAs with the Prescription	% Samples Compliant
RMZ - Type Np Prescriptions	571	87%
RMZ - Type Ns Prescriptions	449	93%
Western Washington RMZ - Type F or S No Inner Zone Harvest	181	63%
Type Forested Wetlands	118	100%
Type B Wetlands	105	100%
Western Washington RMZ - Type F or S Desired Future Condition Option 2	95	63%
Type A Wetlands	54	64%
Western Washington RMZ - Type F or S No Outer Zone Harvest	54	93%
Eastern Washington RMZ - Type F or S No Inner Zone Harvest	40	85%
Eastern Washington RMZ - Type F or S No Outer Zone Harvest	17	83%
Western Washington RMZ - Type F or S Desired Future Condition Option 1	13	73%
Eastern Washington RMZ - Type F or S Inner Zone Harvest	0	0

From this the reader can view the population size across the state and the associated compliance rates of each prescription.

Emphasis Sample: RMZ for exempt 20-acre parcels
This section includes discussion on the Emphasis Sample RMZ exempt 20-acre parcels because it was designed as a one year sample.

The RMZ exempt 20-acre parcels prescription type showed 57% of the population was compliant with all FP rules in the prescription type. The 28 sites sampled represented a census of the population. The 2008 compliance rate was 62% with a 95% confidence interval of (54, 68). Because the 2012 57% compliant (based on a complete census) lies within the 2008 confidence interval, the 2012 compliance rate is not significantly different from the 2008 compliance rate for RMZ exempt 20 acre parcels. This means that the compliance rate in 2008 and the compliance rate in 2012 are statistically the same and that there has been no change in compliance for RMZ exempt 20-acre parcels since 2008.

The FPAs in the emphasis population were from June 2011 through June 2012. The FP Program wrote a Compliance Action Plan in May 2011 which delineated steps to help improve compliance for specific prescription types, including RMZ exempt 20-acre parcels. The Compliance Action Plan requested that the following actions occur for RMZ exempt 20-acre parcel FPAs:

- The applicant was requested to notify the forest practices program 48 hours prior to beginning harvest operations;
- Forest practices foresters will make a minimum of two on-site evaluations during the active period of the FPA; and
- Continue compliance monitoring surveys of RMZ exempt 20-acre parcel harvests.

The Regions reported that very few RMZ exempt 20-acre parcel landowners notified the DNR prior to beginning harvest operations and that the forest practices foresters visited some of the FPAs, typically post- harvest.

While these 2012 results suggest that further review is needed to determine the best steps for improving compliance on RMZ exempt 20-acre parcels, it is important to note that RMZ exempt 20-acre parcels from January 2005 – January 2011 accounted for only 2.2% of all FPAs or approximately 102 FPAs per year on average.

The FP program will pursue options that could improve compliance such as educational opportunities for RMZ exempt 20-acre parcel landowners and operators through media and meeting events, training opportunities in collaboration with stakeholders that represent the landowner, consultant, and operator communities.

Haul Routes
The sample size of the 2012 haul route assessment was large enough to allow comparison between 2011 and 2012 results. Compliance rate mean values in 2012 and 2011 respectively were: 88% and 96%. An approximate 95% confidence interval for the difference between 2011 and 2012 compliance rates is (-4.4%, 21%), which includes zero. Therefore, there is no statistical difference between these two years and both years' rates are near or above DNR's compliance goal of 90%.

Interim Riparian and Wetland Prescriptions
Western Washington interim riparian prescription findings appear to show a tendency of improvement for compliance with prescriptions for No Outer Zone Type S and F harvest, and Type N prescriptions. Findings on Western Washington prescriptions for No Inner Zone Harvest, and DFC Option 1 and 2 are lower within the sample. All Eastern Washington prescriptions show a tendency of improvement for

compliance. Full confidence in the sample results will only be available upon completion of the biennial sample.

CMP Challenges

Representation of Complete Compliance

There is a danger with interpretation and perception when compliance rates are calculated and presented. The reader should avoid interpreting a deviation assessment as a failure of the prescription. It is merely an assessment of whether the prescription was in compliance with every FP rule included in the prescription or not. In most situations where there is deviation from at least one FP rule in the prescription, there is compliance with most of the remaining FP rules in the prescription. In fact, it is not unusual for prescriptions rated with a minor deviation to also exceed rule requirements for some FP rules. For example, if there are too few outer zone trees, often there are also excess trees in the inner zone, where trees have greater riparian benefits to streams. In this example, the letter of the rule may not be met, but many more trees remained in the RMZ than the minimum required by rule.

Since an average compliance rate for a prescription cannot be provided (see Section 2.3 for more information) for all prescription types except the haul route prescription type, the ratings of minor, moderate, and major help to understand level of deviation from rule when it occurs.

The expectation is for landowners to follow all the FP rules. But there is more to evaluating compliance with the FP rules than simply a compliance rating for prescription types. The CMP continues to work toward finding better ways to report a more complete picture of compliance.

Sample and Measurement Error

The CMP resolves the inability to determine statistical variability on average values by assigning a standard absolute 5% measurement error tolerance. This measurement error tolerance applies for only two specific measurements, when determining: 1) stream widths, or, 2) buffer widths or floors within no-harvest RMZ areas. When a landowner's average value is within 5% of the compliance monitoring field team's average value the values are considered the same. If the landowner's average value falls outside the 5% it is assumed the compliance monitoring field team value is correct and the landowner's average value is incorrect.

Measurement methods involving averages such as steam width continue to be contentious because of the application of the absolute error value of 5%. This is problematic when the stream width is very near the threshold width. Imposing the set value of 5% can be imprudent when there is high variability in individual stream width measurements.

There are statistical approaches that use the measurement data to assess the probability of meeting threshold values. The CMP will be assessing the methods in the coming months.

Variation in Natural Conditions

Because natural features are variable, onsite conditions do not fit neatly into FP rule categories. When this occurs, review team members may opt to record the compliance as indeterminate. The challenge is to improve understanding of the conditions and rule to minimize indeterminate calls. This may involve revisiting rule interpretation and how to apply the rules for the imprecise situations or developing suggested changes to make FP rules clearer.

Shade
Shade is a key function provided by the RMZ and as such is of interest to the CMP for monitoring, however, as stated in section 2.5, compliance monitoring of riparian shade rules has presented challenges which have precluded the ability to monitor for shade compliance.

Shade is currently included in compliance monitoring protocols in the following ways:

- Section 6 of the CMP protocols state "*Any harvest proposed within 75 ft. of BFW requires documentation of adequate shade per WAC 222-30-040. If no documentation is present any harvest within 75 ft. is considered non-compliant*", and
- Section 8 of the CMP protocols state "*Any harvest proposed within 75 ft. of BFW requires documentation of adequate shade per WAC 222-30-040. Without shade documentation, harvests within 75 ft. shall be non-compliant with the rules, though the harvest could still be compliant with the FPA*".

The first protocol assumes that checking to see if shade documentation is attached to the FPA will be sufficient to be able to assess if the FP rule is followed that requires the landowner to demonstrate that a tree to be harvested within 75 feet of BFW would not be needed to maintain compliance with stream temperature standards (WAC 222-30-040(2)). The CMP protocol would have to be rewritten to better address the compliance monitoring field team determining the adequacy of information submitted with the FPA.

The second protocol assumes that if the documentation is submitted with the FPA, then the post-harvest condition must certainly meet the conditions prescribed by the board manual nomograph. This type of assumption is not made elsewhere in compliance monitoring and it is questionable as to whether it should be used here.

Not only is checking shade documentation for compliance an issue but taking measurements in the field to determine if the required amount of vegetation was left to meet temperature standards is also an issue. There are concerns of measurement repeatability using the densiometer (which is the instrument that is used to determine shade). Also, the trees have been harvest so it's impossible to recreate original conditions. Currently, CMP does not take shade measurements in the field.

The CMP will be reviewing several approaches to this assessment in the coming year to determine if a reasonable approach to field shade assessment can be found.

7. Conclusion

The Compliance Monitoring program provides a systematic, unbiased approach to determine forest practices compliance. The process is built on a biennial cycle with two field seasons (years) of collecting data to obtain required sample sizes. The Standard Sample observed in 2012 is not sufficient to make statistically precise comparisons for prescription types, with the exception of haul routes.

The Emphasis Sample, RMZ exempt 20-acre parcels, showed 57% of samples were assessed as compliant with all the FP rules included in the prescription type. Statistically, this indicates that compliance has not changed for this prescription type since 2008 (62%) when the prescription type was initially sampled.

Haul route compliance rates continue to meet standards.

CMP works to identify challenges and search for solutions for those challenges or to identify acceptable alternatives.

8. Recommendations

RMZ exempt 20-acre parcels
The FP program should continue to pursue options that can help to increase compliance for this prescription type.

Haul Routes
Landowners and the FP Program should continue to follow the current successful process for maintaining and complying haul routes as well as continue to work toward increasing compliance rates.

Challenges
Shade - The FP Program, CMP, and the Compliance Monitoring Stakeholder Committee should continue to consider how the shade rules could be effectively monitored and as part of that process, review the existing shade protocols for possible revision.

9. FP Program/FP Rule Changes Based on Compliance Monitoring Feedback

While no Forest Practices rule changes were made as a result of the CMP 2010/2011 biennium report findings, the Forest Practices program has responded with a number of actions to address issues detected through compliance monitoring.

Development of Water Type Modification Form
Water Typing problems were illuminated in the 2010-2011 CMP report. In response the agency took two actions. The Water Type Modification Form was revised to provide better detail about the location of water type breaks and stream physical characteristics, and the Water Type Classification Worksheet was revised to require applicants to review the reach upstream to assess if Type F water physical characteristics are present.

Administrative Changes regarding Shade Rule Documentation
CMP review of the shade rule discovered that there was no requirement for applicants to document their shade assessment when harvesting adjacent to a Type S or F stream within 75 ft. of bankfull width except for FPAs associated with exempt 20-acre parcels. In response the FP program revised the FPA form. This revision in question 21 directs all applicants to "*Include stream shade analysis calculation if you are harvesting within 75 feet of S or F waters.*" This direction will provide a record in the FPA documenting the assessment results. See Appendix B for information from 2012.

Water Type/Bankfull Width Training
In response to the need to improve water classification skills the FP program developed Water Type and Bankfull Width training which is being presented to all DNR region FP staff. This will provide the basis for consistent interpretation statewide. Once all region staff is trained, the training will be provided for Timber/Fish/Wildlife (TFW) participants during TFW meetings in each region.

10. Glossary

Bankfull Width –
(a) For streams – The measurement of the lateral extent of the water surface elevation perpendicular to the channel at bankfull depth. In cases where multiple channels exist, bankfull width is the sum of the individual channel widths along the cross-section (see board manual section 2).

(b) For lakes, ponds, and impoundments – Line of mean high water.

(c) For tidal water – Line of mean high tide.

(d) For periodically inundated areas of associated wetlands – Line of periodic inundation, which will be found by examining the edge of inundation to ascertain where the presence and action of waters are so common and usual, and so long continued in all ordinary years, as to mark upon the soil a character distinct from that of the abutting upland.

Basal Area – the area in square feet of the cross section of a tree bole measured at 4 1/2 feet above the ground.

Bull Trout Habitat Overlay – those portions of Eastern Washington streams containing bull trout habitat as identified on the department of fish and wildlife's bull trout map.

Channel Migration Zone – the area where the active channel of a stream is prone to move and this results in a potential near-term loss of riparian function and associated habitat adjacent to the stream, except as modified by a permanent levee or dike. For this purpose, near-term means the time scale required to grow a mature forest. (See board manual section 2 for descriptions and illustrations of CMZs and delineation guidelines.)

Clearcut – harvest method in which the entire stand of trees is removed in one timber harvesting operation (except for trees required by rule or law to be left uncut).

Confidence Interval – type of interval estimate of a population parameter and is used to indicate the reliability of an estimate. Confidence intervals consist of a range of values (interval) that act as good estimates of the unknown population parameter.

Crown closure – percent of canopy overlying the forest floor.

Desired Future Condition (DFC) – a reference point on a pathway and not an endpoint for stands. DFC means the stand conditions of a mature riparian forest at 140 years of age, the midpoint between 80 and 200 years. Where basal area is the only stand attribute used to describe 140-year old stands, these are referred to as the “Target Basal Area.”

Diameter Breast Height (DBH) – the diameter of a tree at 4-1/2 feet above the ground measured from the uphill side.

Dominant and Co-dominant Trees –

- Dominant – Trees or shrubs with crowns receiving full light from above and partly from the side; usually larger than the average trees or shrubs in the stand, with crowns that extend above the general level of the canopy and that are well developed but possibly somewhat crowded on the sides.
- Co-dominant – a tree that extends its crown into the canopy and receives direct sunlight from above but limited sunlight from the sides. One or more sides of a co-dominant tree are crowded by the crowns of dominant trees.

Equipment Limitation Zone – a 30-foot-wide zone measured horizontally from the outer edge of the bankfull width of a Type Np or Ns Water. It applies to all perennial and seasonal non-fish bearing streams.

Finite population correction factor – The finite population correction factor is a formula often used in statistics and probability. This formula allows you to adjust a population from bigger to smaller or to indicate no change in the population. The result of the formula's calculation is called the z-factor.

Flood level – 100 year means a calculated flood event flow based on an engineering computation of flood magnitude that has a 1 percent chance of occurring in any given year.

Forest Practices Application/Notification (FPA/N) – Is the form used by forest landowners to notify DNR they are conducting a Class II forest practice or to apply for approval of forest practices for a Class III or Class IV forest practice.

- An FPN is a notification to DNR that a Class II forest practice will take place. Class II forest practices have been determined to have less than ordinary potential to damage a public resource.
- An FPA is an application for a permit to conduct a Class III or Class IV forest practice. Class III and Class IV forest practices have a higher potential to impact a public resource than does a Class II forest practice.

End hauling means the removal and transportation of excavated material, pit or quarry overburden, or landing or road cut material from the excavation site to a deposit site not adjacent to the point of removal.

Forest road means ways, lanes, roads, or driveways on forest land used since 1974 for forest practices. "Forest road" does not include skid trails, highways, or local government roads except where the local governmental entity is a forest landowner. For road maintenance and abandonment planning purposes only, "forest road" does not include forest roads used exclusively for residential access located on a small forest landowner's forest land.

Full bench road means a road constructed on a side hill without using any of the material removed from the hillside as a part of the road. This construction technique is usually used on steep or unstable slopes.

Laser hypsometer – instrument that measures distances to the top and bottom of objects, and the angle between the lines from the observer to each to calculate height of the object.

Partial Cut strategy – the removal of a portion of the merchantable volume in a stand of timber so as to leave an uneven-aged stand of well-distributed residual, healthy trees that will reasonably utilize the productivity of the soil.

Public Resources – water, fish, and wildlife and in addition means capital improvements of the state or its political subdivisions.

Riparian function includes bank stability, the recruitment of woody debris, leaf litter fall, nutrients, sediment filtering, shade, and other riparian features that are important to both riparian forest and aquatic system conditions.

Riparian Management Zone – A Riparian Management Zone (RMZ) is the area that is located on each side of a Type S, F or N stream where trees are left to provide protection from disturbance when forest practices activities such as timber harvest are conducted.

Sensitive sites – are areas near or adjacent to Type Np Water and have one or more of the following:

- **Headwall seep** is a seep located at the toe of a cliff or other steep topographical feature and at the head of a Type Np Water which connects to the stream channel network via overland flow, and is characterized by loose substrate and/or fractured bedrock with perennial water at or near the surface throughout the year.
- **Side-slope seep** is a seep within 100 feet of a Type Np Water located on side-slopes which are greater than 20 percent, connected to the stream channel network via overland flow, and characterized by loose substrate and fractured bedrock, excluding muck with perennial water at or near the surface throughout the year. Water delivery to the Type Np channel is visible by someone standing in or near the stream.
- **Type Np intersection** is the intersection of two or more Type Np Waters.
- **Headwater spring** means a permanent spring at the head of a perennial channel. Where a headwater spring can be found, it will coincide with the uppermost extent of Type Np Water.
- **Alluvial fan** means a depositional land form consisting of cone-shaped deposit of water-borne, often coarse-sized sediments.

Sidecast – act of moving excavated material to the side and depositing such material within the limits of construction or dumping over the side and outside the limits of construction.

Significance level – A fixed probability of wrongly rejecting the null hypothesis H0, when the hypothesis is in fact true. The smaller the significance level the better the protection for the null hypothesis and prevent, as far as possible, the investigator from inadvertently making false claims.

Site Class:
The site class is a growth potential rating for trees within a given area based upon soil surveys. The designated site class along type S or F streams will determine the width of the RMZ.

Site Index: An index based on ranges of site classes. For example:

(state soil survey)	**50-year site index range**
I	137+
II	119-136
III	97-118
IV	76-96
V	<75

Stand Requirement – A number of trees per acre, the basal area and the proportion of conifer in the combined core and inner zone so that the growth of the trees would meet desired future condition.

Stream Adjacent Parallel Roads – roads (including associated right of way clearing) in a riparian management zone on a property that have an alignment that is parallel to the general alignment of the stream, including roads used by others under easements or cooperative road agreements. Also included are stream crossings where the alignment of the road continues to parallel the stream for more than 250 feet on either side of the stream. Not included are federal, state, county or municipal roads that are not subject to forest practices rules, or roads of another adjacent landowner.

Temporary road – a forest road that is constructed and intended for use during the life of an approved forest practices application/notification.

Uppermost point of perennial flow – The point in the stream where stream water begins to flow perennially (year round) downstream.

Wetland Management zone – Area located around the perimeter of a wetland where trees are left to provide protection from disturbance, as well as shade and nutrients for the wetlands.

Yarding Corridor – a narrow, linear path through an RMZ to allow suspended cables necessary to support cable logging methods or suspended or partially suspended logs to be transported through these areas by cable logging methods.

11. Appendix

Appendix A

Statistical Methods

Methods for Confidence Intervals

There are two types of compliance proportions estimated in this report, simple proportions and ratio proportions. Estimation for both types is described below with examples.

Simple Proportions

Most compliance proportions estimated in this document are simple proportions. FPAs containing individual prescriptions are sampled until the target sample size is reached. One prescription is evaluated for each FPA, so the compliance proportion is simply the number of compliant FPAs divided by the total sampled for each prescription. This is a binomial proportion, and 95 percent confidence intervals were estimated using the F-distribution as described in Zar (1996; p524):

$$LCL = \frac{X}{X + (n - X + 1) * F_{\alpha(2),\nu 1,\nu 2}},$$

$$UCL = \frac{(X + 1) * F_{\alpha(2),\varpi 1,\varpi 2}}{n - X + (X + 1) * F_{\alpha(2),\varpi 1,\varpi 2}},$$

Where
LCL = Lower Confidence Limit
UCL = Upper Confidence Limit
X = the number of compliant activities
n = the total number of activities,
F = the F-distribution critical value for the given alpha and degrees of freedom,

$$\nu 1 = 2(n - X + 1)$$

$$\nu 2 = 2X$$

$$\varpi 1 = 2(X + 1)$$

$$\varpi 2 = 2(n - X).$$

These binomial confidence intervals are not symmetric.

Because there is a finite population of FPAs, we correct the confidence intervals using the finite population correction factor. The overall population size for each prescription (i.e., the number of completed FPAs containing the prescription) is not known, but can be estimated based on the number of FPAs that were opened and were found to be part of the population containing the given prescription. We estimate N for an individual prescription as follows:

$\widehat{N} = \frac{n_1 \times F_1}{f_1}$,

Where
F_1 = the total number of FPAs approved in Year 1,
f_1 = the number of FPAs evaluated for membership in the population ("opened") in Year 1,
n_1 = the number of FPAs opened that contained road/riparian prescriptions in Year 1,

The finite population correction factor (FPCF) is $1 - \frac{n}{\widehat{N}}$.

To correct the confidence intervals for the finite population, we follow the equation in Zar (1996, p 527) as follows:

$$LCL_c = \frac{X - 0.5}{n} - \left(\frac{X - 0.5}{n} - LCL\right) \times \sqrt{1 - \frac{n}{\widehat{N}}}$$

$$UCL_c = \frac{X + \frac{X}{n}}{n} + \left(UCL - \frac{X + \frac{X}{n}}{n}\right) \times \sqrt{1 - \frac{n}{\widehat{N}}}$$

It is possible for the upper confidence bound to exceed 100% - in these cases the confidence bound is set to100%.

Example

The proportion of statewide Type A Wetland prescriptions that are compliant is an example of a simple proportion. For 2012, there were 12 FPAs containing Type A Wetland prescriptions that were evaluated for application compliance. Of these, 10 were compliant with the application.

n = 12
X = 10

10/12 = 0.83 (83% compliant)

$\nu 1 = 6$
$\nu 2 = 20$
$\varpi 1 = 22$
$\varpi 2 = 4$

$$LCL = \frac{10}{10 + (12 - 10 + 1) * 3.128} = 0.52(52\%)$$

$$UCL = \frac{11 * 8.533}{12 - 10 + (11) * 8.533} = 0.98(98\%)$$

The population estimate for 2012 Type A Wetlands is 54. Correcting for finite populations:

$$LCL_c = \frac{10 - 0.5}{12} - \left(\frac{10 - 0.5}{12} - 0.52\right) \times \sqrt{1 - \frac{12}{54}} = 0.55\ (55\%)$$

$$UCL_c = \frac{10 + 0.83}{12} + \left(0.98 - \frac{10 + 0.83}{12}\right) \times \sqrt{1 - \frac{12}{54}} = 0.97\ (97\%)$$

In this case, the FPCF changed the confidence interval from (52,98) to (55,97).

Ratio Proportions

There are some compliance proportions that are estimated using a ratio proportion. This is necessary when both the numerator and the denominator of the proportion are random variables. The only estimation that used a ratio proportion for 2012 was the haul route analysis. The haul route compliance for each FPA is the length of road that is compliant divided by the length of road evaluated. Because the length of road being evaluated differs among FPAs, the denominator of the compliance ratio is a random variable. In this case, the estimated compliance proportion is:

$$\hat{p} = \frac{\sum_{i=1}^{n} y_i}{\sum_{i=1}^{n} x_i},$$

which is the total length of compliant haul route segments divided by the total length of haul route segments that were sampled across all FPAs (*n* is the number of FPAs sampled).

A 95 percent confidence interval for the proportion compliant is formed as follows:

$$\hat{p} \pm t_{.025,(n-1)} \cdot SE(\hat{p})),$$

where $t_{.025,(n-1)}$ is the 97.5th percentile of the student-*t* distribution with (*n*-1) degrees of freedom, *n* is the number of sampled FPAs, and

$$SE(\hat{p}) = \frac{\sqrt{n \cdot (1 - \frac{n}{N}) \cdot \sum_{i=1}^{n} (y_i - \hat{p}x_i)^2}}{\sqrt{(n-1)} \cdot \sum_{i=1}^{n} x_i}$$ (Cochran, 1977, p32).

These confidence intervals are symmetric. Note that the FPCF is already built in to this equation. It is possible for the upper confidence bound to exceed 100% - in these cases the confidence bound is set to100%.

Appendix B

Shade

As discussed in the body of the report,

- There are problems with the existing compliance monitoring protocols used to assess shade compliance which could result in erroneous assessments of whether the post-harvest RMZ meets the shade conditions expected under the rule.
- There is also an issue regarding field measurements for determining shade compliance post-harvest that precludes the ability to monitor the shade rules. There are concerns of measurement repeatability using the densiometer (which is the instrument that is used to determine shade). The issues of repeatability come into play because it is difficult for different users to get the same results and the same user may get different results at different times of the year.

CMP does not engage in monitoring shade for the reasons stated above. However, stakeholders requested that CMP collect some information while in the field. The table below provides the requested information.

Table 30 – Shade Information

Harvest Strategy	**Total Sample Count**	**# Where Harvest Occurred within 75 ft. of BFW**	**# DFC Not Completely Compliant** (not including shade rule)	**# DFC Compliant** (not including shade rule)
DFC 1	11	9	3	6
DFC2	16	0	0	0

DFC2 option had no instances of harvest within 75 ft. of BFW

DFC1 option had 9 instances of harvest within 75 feet of BFW. Six of nine where harvest occurred within 75 feet were compliant with rules being monitored (those rules did not include the shade rules). They met DFC stocking requirements.

12. References

Cochran, William G. (1977). Sampling Techniques. John Wiley & Sons, New York.

Efron, Bradley (1987). “Better Bootstrap Confidence Intervals.” Journal of the American Statistical Association, 82 (397): 171-185.

Zar, Jerrold H. (1996). Biostatistical Analysis. Third Edition. Prentice Hall. Upper Saddle River, New Jersey.