FOREST PRACTICES BOARD

Special Board Meeting (Field Tour) – November 7, 2017

Camas Center for Community Wellness, 1821 North LeClerc Road, Cusick, WA

Members Present

Stephen Bernath, Chair, Department of Natural Resources
Bob Guenther, General Public Member/Small Forest Landowner
Brent Davies, General Public Member
Dave Herrera, General Public Member
Heather Ballash, Designee for Director, Department of Commerce
Lisa Janicki, Elected County Official
Patrick Capper, Designee for Director, Department of Agriculture
Paula Swedeen, General Public Member
Tom Laurie, Designee for Director, Department of Ecology
Tom Nelson, General Public Member

Members Absent

Carmen Smith, General Public Member/Independent Logging Contractor
Joe Stohr, Designee for Director, Department of Fish and Wildlife
Noel Willet, Timber Products Union Representative

Staff

Joe Shramek, Forest Practices Division Manager
Marc Engel, Forest Practices Assistant Division Manager
Patricia Anderson, Rules Coordinator
Phil Ferester, Senior Counsel

The Forest Practices Board received a welcome from Curt Holmes, Kalispel Tribal Council Member at the Camas Center for Community Wellness**.** The Board then traveled to various land parcels owned by either Kalispel Tribe or Hancock Forest Management. The field tour included presentations on tribal cultural resources, concepts of water typing, herbicide use in forest management, forest health in eastern Washington, and small forest landowner issues.

Field tour ended at 4:30 p.m.

FOREST PRACTICES BOARD
Regular Board Meeting – November 8, 2017
Northern Quest Resort & Casino, 100 North Hayford Road, Airway Heights, Spokane, WA

Members Present
Stephen Bernath, Chair, Department of Natural Resources
Brent Davies, General Public Member
Dave Herrera, General Public Member
Heather Ballash, Designee for Director, Department of Commerce
Lisa Janicki, Elected County Official
Patrick Capper, Designee for Director, Department of Agriculture
Paula Swedeen, General Public Member
Tom Laurie, Designee for Director, Department of Ecology
Tom Nelson, General Public Member

Members Absent
Bob Guenther, General Public Member/Small Forest Landowner
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Joe Stohr, Designee for Director, Department of Fish and Wildlife
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WELCOME AND INTRODUCTIONS
Stephen Bernath called the Forest Practices Board (Board) meeting to order at 9:00 a.m.

PUBLIC COMMENT ON FIELD TOUR
Ken Miller, Washington Farm Forestry Association (WFFA), thanked the Board for the tour. He shared his takeaways which included eastern Washington riparian forest fire resiliency needs to become one of the key riparian functions, and that eastern Washington economics and riparian stand complexity for small forest landowners requires less prescriptive rules and more professional judgement by experts in the field.

Dr. Elaine Oneil, WFFA, provided an overview how the intent of the eastern Washington riparian rules were to incorporate forest disturbance into management of riparian areas while simultaneously protecting fish and water quality. She said she cannot ignore the fact that even with additional accommodation for small forest landowners, using an alternate plan template approach is unlikely to attain adequate objectives to improve riparian forest health, fire resilience, riparian function for fish, and water quality needed in eastern Washington. For those reasons, she believes an eastside riparian rule change is needed to meet these multiple objectives across the entire landscape of eastern Washington and to be consistent with the goals outlined in the new DNR 20-year Forest Health Plan.

Ray Entz, Kalispel Tribe, said eastern Washington has a lot of complicated issues and there is no quick fix solution. He said a balance between with rules and science is needed to ensure eastside fire regime forests thrive.

Mark Doumit, Washington Forest Protection Association (WFPA), thanked the Board for the tour and appreciated the statements made by Patty Playfair about protecting the small forest landowner community. He believes everyone is trying to find common goals and is working together to solve the forest health, fire and economic problems in the forested landscapes of eastern Washington.

Karen Terwilleger, WFPA, expressed her appreciation for seeing the eastern Washington issues involving tribal cultural resources, water typing, forest chemicals and forest health on the ground. She believes communication in the field is key in meeting resource objectives as well as cultural, social, and economic objectives. She specifically appreciated seeing and hearing about the specific water typing concerns on the eastside and was encouraged by the discussions around the fish habitat assessment methodology.

Mary Scurlock, Conservation Caucus, thanked the Kalispel Tribe. She expressed her caucuses' concerns on the importance of stream typing for resource protection and believes the use of the board accepted fish habitat assessment method for inclusion in the permanent water typing rule will provide a more accurate stream typing system. She also said she would welcome a conversation on managing for fire resiliency in riparian areas, but does not want to see fire resiliency become more important than established riparian functions.

Jaime Glasgow, Conservation Caucus, provided his observation on the importance of getting the correct water typing call using an example of a stream visited during the tour. He explained how the stream observed during the tour stop was downgraded from a Type F to a Type N even though it met the rule-defined default physical criteria for fish habitat. He believes the new fish habitat assessment methodology will be able to more accurately identify Type F/N breaks and treat waters connected to known fish waters as Type F waters if access by fish is a primary component used as PHB criteria.

Vic Musselman, WFFA, thanked the Board for the tour. He read written testimony from Phil Hess. The testimony stressed the need for a more holistic eastern Washington riparian forest approach to include management for fire resiliency within riparian areas. In addition, he stated that the current eastern Washington riparian rules are not consistent with the best available science, and asked the Board to consider an emergency rule to address eastern Washington riparian forests before the next fire season.

RECAP OF FIELD TOUR

Chairman Bernath said he appreciated the welcome and sharing by Curt Holmes, Kalispel Tribal Council Member. He also thanked the presenters on the tour--Kevin Lyons, Joe Maroney, Ray Entz, Kalispel Tribe; JD Marshall, Hancock Forest Management; Patty Playfair, Steve Barnowe-Meyer, small forest landowners; Kelly McLain, Department of Agriculture; and Steve Harris, DNR Northeast Region.

All Board Members echoed their appreciation to those that helped with and presented at the tour. The following comments were shared:

- Appreciation for how small forest landowners and tribes have been working together
- The tour was valuable for learning about eastern Washington issues
- Appreciation for how the tour helped foster communication for resolving these issues and building relationships
- The tour was valuable for learning more about fire regimes on the eastside and small landowner perspectives regarding riparian health
- Impressive to learn about Kalispel's resourcefulness and resiliency to improve tribal life
- Appreciated hearing landowner's concerns and willingness to work together
- Acknowledgment that fire resiliency might need to be looked at as an ecosystem function, not necessarily a riparian function.

Paula Swedeen suggested requesting Dr. Paul Hessberg from the USDA Forest Service Pacific Northwest Research Station provide a presentation to the Board on forest health.

APPROVAL OF MINUTES

Bernath noted on page 9, line 23 and 24, that the votes of Swedeen and Carmen Smith were recorded incorrectly. The action on Dave Herrera's amendment at the August meeting should reflect that Swedeen was in support of the motion and Smith was opposed. The outcome remains the same, and the correction will be reflected in amendment.

MOTION: Tom Laurie moved the Forest Practices Board approve the August 9 meeting minutes as amended.

SECONDED: Brent Davies

ACTION: Motion passed. 8 support / 1 abstention (Janicki)

REPORT FROM CHAIR

Stephen Bernath reported on the following:

- The Forest Practices Small Forest Landowner Office is having to suspend outreach and work in the Forestry Riparian Easement and Rivers and Habitat Open Space programs since a capital budget has not been passed by the legislature.
- Suggested a two day meeting in February – the first day would be a work session emphasizing the expert panel's work in developing recommendations for Potential Habitat Breaks and the second day would be the regular Board meeting.
- The tribal cultural resources facilitated process has not had much movement. DNR is trying to coordinate scheduling of a meeting between state, landowner and tribal leadership.
- DNR Commissioner Franz is leading an update of a DNR Strategic Plan based on the DNR's priorities. This will be shared with the Board at a future meeting.
- Terry Jackson, long time Washington Department of Fish and Wildlife (WDFW) contributor in the Cooperative Monitoring, Evaluation and Research Committee (CMER) and TFW Policy, retired at the end of October.
- Executive Session will focus on the Sumas Case

- The financial and performance audit of the Adaptive Management Program is underway and has three components: contracts around participation grants with tribes; pass-through monies provided to non-government organizations; and financial elements of CMER contracts. A report will be presented to the Board when completed.
- There was a recent change within DNR affecting Pacific Cascade Region leadership within the forest practices program: Bob Johnson will transition into Wildfire and Forest Practices Assistant Region Manager, replacing Chuck Turley (who will become Wildfire Division Manager).
- The updated Forest Practices Illustrated is available on-line. Board members will be receiving a copy and the Forest Practices Program. Updates to the Forest Practices Illustrated will be made as needed to the on-line version.

PUBLIC COMMENT (AM)

Ken Miller, WFFA, invited the Board to attend the annual WFFA meeting to be held in Winthrop on May 20, 2018. He further asked the Board to include on their 2018 work plan a field tour to his property to better understand the small landowner's request for a western Washington low-impact alternative plan template.

Dr. Elaine Oneil, WFFA, echoed Ken's invitation to the WFFA annual meeting. She said Dr. Paul Hessberg is on the agenda to provide a presentation on mega fires.

NORTHERN SPOTTED OWL CONSERVATION ADVISORY GROUP

Marc Engel, DNR, stated the northern spotted owl conservation advisory group is identified in rule and, when a protocol survey shows the absence of spotted owls within a site circle, how the group is convened to evaluate the need to maintain existing spotted owl habitat to enhance connectivity with adjacent spotted owl habitat. Although the group has never been called to evaluate the results of a protocol survey, he recommended the Board maintain this group in event a review is necessary.

Paula Swedeen said the rule was developed because at one time it was a practice for WDFW to decertify spotted owl site circles. She said since the rule was adopted, it seems the process for WDFW to accept spotted owl surveys and to decertify spotted owl site circles is not as common as it once was.

PUBLIC COMMENT ON CONSERVATION ADVISORY GROUP

None.

NORTHERN SPOTTED OWL CONSERVATION ADVISORY GROUP

MOTION: Brent Davies moved the Forest Practices Board maintain the Northern Spotted Owl Conservation Advisory Group.

SECONDED: Lisa Janicki

ACTION: Motion passed unanimously.

PUBLIC RECORDS FEE SCHEDULE RULE MAKING

Marc Ratcliff, DNR, requested the Board's approval to file a CR-102 for the public records fee schedule rule making. He reminded the Board that the CR-101 was filed in August and the purpose for the CR-102 is to allow the public to review the draft rule language and provide an opportunity for the public to provide comments.

Staff reported that the Board receives very few substantial public records requests. Ratcliff said the Board does not have an accurate accounting related to specific costs to process public record requests, nor the resources to conduct a study. For those reasons, staff recommended using the public disclosure fee rates established in statute. The new fee schedule reflects an expansion to cover all record formats, from paper to electronic files.

Ratcliff concluded that upon the Board's approval, staff would file the CR-102 in December 2017, conduct a public hearing in January, and prepare for the Board's adoption in February 2018.

PUBLIC COMMENT ON PUBLIC RECORDS FEE SCHEDULE RULE MAKING
None.

PUBLIC RECORDS FEE SCHEDULE RULE MAKING
MOTION: Tom Nelson moved the Forest Practices Board approve the draft public records fee rule language and direct staff to initiate rulemaking by filing a CR-102 with the Office of the Code Reviser.

SECONDED: Lisa Janicki

ACTION: Motion passed unanimously.

CLARIFICATION ON EARLIER DISCUSSIONS
In response to an invitation from WFFA made earlier in the meeting, Bernath reminded Board members to let Patricia Anderson know if they plan to attend WFFA's annual meeting. If a quorum or more (7) of board members attend, the WFFA conference would need to be advertised as an open public meeting.

He further clarified that DNR Northeast Region's forest fuel reduction staff is funded by grants (including state capital) used for fuels reduction projects. Forest practices technical assistance consultations for small forest landowners is minor since the fuels reduction staff are not funded for that purpose. Currently, the Small Forest Landowner Office has only two funded positions, and both are located in western Washington.

PUBLIC COMMENT (PM)
Kevin Godbout, Weyerhaeuser, briefed the Board on Weyerhaeuser's water typing process. He provided examples of how the stream physical attributes and habitat suitability are used in combination for a complete water typing survey. He said the water typing assessment process is more complex than simply evaluating if fish habitat is accessible. Under the current water typing process, and in the last four years, Weyerhaeuser has upgraded an additional 34 miles of fish streams from what the water typing model had predicted.

Steve Barnowe-Meyer, WFFA, said the Clean Water Act report shows the small landowner road improvement milestone is off-track, and that Department of Ecology's (Ecology) assessment of satisfying this milestone seems no longer feasible. He offered WFFA's commitment to work with DNR and Ecology for identifying and implementing alternatives to meet this milestone.

Mary Scurlock, Conservation Caucus, urged DNR to increase their rigor for reviewing water type modification forms (WTMF) in the 2018 water typing survey field season. Their suggestions include the need for a new WTM form, increased effort to implement current direction in rule, and requiring affirmative concurrence from at least one other TFW reviewer. She also urged the Board to not delay in beginning Board Manual development until after the February meeting.

Ray Entz, Kalispell Tribe and Upper Columbia United Tribes, said because of accountability issues, they will no longer be participating formally within the TFW Policy Committee (Policy). He believes their concerns were not taken seriously by Policy and they will now take their concerns directly to the Board.

Karen Terwilliger, WFPA, said they are pleased the adaptive management process is being used to arrive at potential habitat barrier criteria and permanent rule adoption. She suggested the fish habitat assessment methodology is a clarification of the current field method, not a renegotiation of how fish habitat standards will be met. She reminded the Board that language in the Forest Practices Habitat Conservation Plan and Forests and Fish Report define habitat as 'habitat that is likely to be used by fish'. She acknowledged the importance a validation study will be for a successful rule.

Jamie Glasgow, Conservation Caucus, asked the Board to encourage the Adaptive Management Program Administer to use the WTMF data being collected with caution and not used simply to establish the criteria, but to inform the data along with other best available science. They support a report from the science panel to the Board which provides several alternates and for each alternative the report should provide appropriate risks associated with each.

POTENTIAL HABITAT BREAK UPDATE

Hans Berge, Adaptive Management Program Administrator and Joe Maroney, Kalispel Tribe, provided an update on the work being conducted by the board convened science panel to gather additional data to arrive at potential habitat break (PHB) criteria. Berge began by providing a short recap of the science panel's process leading to the report presented to the Board in August and the Board's direction to the science panel since August. He said the science panel is maintaining focus on Board directed parameters (barriers, stream size and changes in gradient) and has attempted to stratify by Level IV Ecoregions. This has proven challenging given the disparate data contained within the WTMFs.

Berge briefly outlined the statistical method used by the science panel to capture the appropriate amount of WTMFs needed to inform the criteria. The panel randomly selected Type F/N points across each ecoregion to gather a representative sample. The target was to capture between 60 to 100 points with data for each ecoregion. There was not enough useable WTMF points in all ecoregions to differentiate between ecoregions and the datasets will need to be aggregated, particularly in eastern Washington. For example, of the 1,268 data points completed to date in eastern Washington across three ecoregions, only 230 data points contained useable information

(i.e., barriers, stream size or gradient). Of the completed 228 data points in western Washington to date, 63 are useable. He said this result does not suggest the data points are incorrect, rather they are not suited for the purpose at hand.

He said in order for the validation study design to meet objectives in the adaptive management process, the study design should be peer reviewed. The recommendation to have a blind peer review requires more time and as a result, the study design will not be brought to the Board until your May 2018 meeting. The three components to the study design will be to: quantify the PHB criteria; ensure repeatability for conducting surveys; and revisiting past documented and concurred last fish points in the field. The study will include an evaluation of seasonality and interannual variability.

Berge reiterated that the process for reviewing and analyzing WTMF data is on schedule to meet the Board's direction for presenting new PHB criteria to the Board in February 2018. He said a revised PHB report would be provided to the Board mid-January and will include details about how the data were sampled, analyzed, and will include recommendations. Efforts will be made to improve how alternatives are explained more clearly than in the report to the Board in August.

Berge discussed how the QA/QC of data is a continual process and presents multiple challenges. The data is tracked and the unacceptable points are further evaluated to ensure a correct representation from the information contained in the forms. The final data set used for analysis will be made available sometime after the November 29th science panel meeting – how that is provided will be determined later, but likely posted on a website.

BOARD SUBCOMMITTEE UPDATE ON EFFICIENCY AND EFFECTIVENESS IMPROVEMENTS FOR THE ADAPTIVE MANAGEMENT PROGRAM

Hans Berge, Adaptive Management Program Administrator, provided an update of the Adaptive Management Program subcommittee's work. He said the request for proposal for selecting a facilitator closed in October. The interview team includes Berge, a member from WDFW, a DNR contracting specialist, Paula Swedeen and Lisa Janicki. This group will evaluate the proposals, rank the applicants and make a recommendation to the subcommittee.

Lisa Janicki said she is pleased with the level of expertise she has seen thus far in the facilitation applications. She said the next meeting is mid-November, and a decision should occur mid-December.

Bernath said the contract is scoped-out and will extend through the end of the biennium. Three meetings are planned thus far. He said the consultant will perform a lot of background work and conduct interviews of various caucuses' members. As a result, the number of meetings between the facilitator and Policy principals may be adjusted as this progresses. It is uncertain how long the subcommittee will function. It was acknowledged that the subcommittee would have oversight responsibility over the facilitator.

CLEAN WATER ACT ASSURANCES ANNUAL REPORT

Marc Hicks, Department of Ecology, provided a brief historical account of how the Clean Water Act assurances were established. The assurances acknowledged that the forest practices rules

would be updated through a formal Adaptive Management Program to ensure forested waters comply with water quality standards. The original agreement established an evaluation to be conducted after ten years. In 2009, Ecology conditionally extended the assurances and established date-certain milestones for meeting expectations. Hicks walked the Board through some of the milestone accomplishments since his last update in 2016:

- Policy has restarted work on the development of guidance for locating the upper most point of perennial flow
- DNR has arranged for independent fiscal and performance audits within the Adaptive Management Program
- CMER has begun to scope a landscape-scale mass wasting study and they have completed a draft study design for evaluating the effectiveness of rule identified landforms
- The Type N Hard Rock Study has been approved by CMER – the companion study in soft rock is on track for being competed in 2018

Hicks reminded the Board that the Eastside Type F Effectiveness Monitoring Study is way off schedule. He also mentioned the future budget shortfall in the Adaptive Management Program. To alleviate those shortfalls, he said Policy has created a project prioritization study subcommittee to make recommendation for study prioritization and for keeping the budget in the black.

Bernath acknowledged WFFA's interest in solving the small landowner road compliance milestone and encouraged DNR staff, WFFA and Ecology meet to discuss options for meeting this milestone. Hicks said Ecology would welcome discussions to move this forward.

In response to a question about resource implications for not meeting milestones, Hicks said that he is unsure of specific resource implications since many of the studies are not complete. If improvements are not made, he said Ecology would have to evaluate their response to further delays or lack of funding in order to meet these milestones.

STAFF REPORTS

Marc Engel, DNR, and Hans Berge, AMPA, provided an update on the Policy review of the small forest landowner's western Washington riparian zone template proposal initiation. Engel provided a brief account of how WFFA submitted and the Board accepted the low-impact template proposal initiation (PI) packet, the Boards remanding of the PI to Policy through the AMPA, and Policy's acceptance of the AMPA's recommendations for a specific policy and science track review of the low-impact template PI.

Engel said the Policy subcommittee has: reviewed the proposed prescriptions to determine how close they come to meeting the protections in the current rules; and is still in the process of reviewing existing alternate plan prescriptions submitted with FPAs to see how close the proposed template prescriptions come to the previously approved alternate plan prescriptions. When complete the subcommittee will give recommendations to Policy regarding the whether the proposed prescriptions meet the standard to be further developed into alternate plan prescriptions for inclusion in a western Washington low-impact riparian zone template.

Berge said the science track involved a literature review of the riparian functions based on the cited science supporting the proposed low-impact template prescriptions. A contract was implemented to complete this review and to answer several questions asked by the subcommittee. The contractor is working on drafting the literature synthesis and answering the subcommittee's questions. He said they hope to have something from the contractor in January, 2018. Involving an independent science peer review required a contract extension through the end of 2018. It is anticipated a full recommendation to Policy will occur in the summer of 2018.

Scott Swanson and Ray Entz, Policy co-chairs, shared Policy's development of a Policy Handbook. The handbook will serve as a living document for caucus policy representatives and each Board member will also receive one. Scott said one goal of the December Policy meeting will be to look at how to re-invigorate relationships within Policy and the principals.

Entz mentioned the agreement within Policy for finalizing a path forward on guidance for locating the upper most point of perennial flow. Entz acknowledged the collaboration between the large landowners and the conservation caucus for getting this done.

Doug Hooks and Todd Baldwin, CMER co-chairs, said chapter seven of the Protocol and Standards Manual was approved by CMER and they are now working on writing Chapter 8, which is a summary of processes such as the independent science peer review process.

Stacey Polkowske, WDFW, said their agency is still utilizing the voluntary landowner plan approach for lynx management. They are collaborating with landowners to update lynx management plans on state and private lands. She said they are working with Canadian entities, conservation organizations and tribes for recovery actions. Gary Bell is the lead on this effort.

2018 WORK PLANNING AND 2017 WORK PLAN REVIEW

Marc Engel, DNR, provided a recap of the 2017 work plan and presented a draft 2018 Work Plan. The Board updated the work plan by adjusting some completion dates and added some tasks.

Stephen Bernath asked Steve Barnowe-Meyer to provide WFFA's perspective on adding an element to the Boards work plan addressing alternatives in reaching conclusion regarding the western Washington riparian zone low-impact template proposal initiation. Barnowe-Meyer welcomed the idea of alternative options to move this along. Engel mentioned the subcommittee had discussed revisiting previously created draft alternate plan templates. One of which addressed conifer restoration prescriptions and one which utilized a combination of the western Washington RMZ rule desired future condition options 1 and 2 into template prescriptions for small forest landowners. Barnowe-Meyer welcomed the idea of considering alternative approaches, but stated he believes these two templates do not address all the identified prescriptions in the western Washington riparian zone low-impact template proposal initiation. He asked the Board to allow the subcommittee the opportunity to work through the elements of the PI and report to the Board in February 2018. The Board accepted this recommendation.

Significant changes to the work plan include the addition of a report by the Policy subgroup and small forest landowners for additional template alternatives and methodologies, and revised completion dates for Board Manual sections.

The Board agreed to the 2018 meeting dates and decided to schedule a two-day meeting in February and August. 2018 meeting dates are February 13 & 14, May 9, August 7 & 8 and November 14.

PUBLIC COMMENT ON 2018 WORK PLAN

Scott Swanson, Policy co-chair, said the Board's actions today to remove and add work for Policy does not follow their normal procedures, as outlined in the recently created handbook for assigning work for Policy.

Mary Scurlock, Conservation Caucus, agreed that a conversation regarding forestry health issues needs to occur, but echoed Scott's concern for how these priorities get integrated into Policy existing workload.

Marc Gauthier, Upper Columbia United Tribes, thanked the Board for coming over to the eastside of the state and asked they consider another visit in the future.

MOTION: Lisa Janicki moved the Forest Practices Board approve the 2018 Proposed Work Plan as amended.

SECONDED: Tom Nelson

ACTION: Motion passed unanimously.

EXECUTIVE SESSION

Executive session occurred from 3:15 p.m. - 3:45 p.m.

Meeting adjourned at 3:46 p.m.

DEPARTMENT OF
NATURAL RESOURCES

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MEMORANDUM

January 26, 2018

TO: Forest Practices Board

FROM: Hans Berge, Adaptive Management Program Administrator

SUBJECT: Recommendations for criteria to establish Potential Habitat Breaks in the Fish Habitat Assessment Method

The Board's motion on 10 May 2017 directed the AMPA to work with a group of internal and external technical team to evaluate criteria to be used as potential habitat breaks (PHBs) in the fish habitat assessment methodology (FHAM) as part of the water typing system. In response, I was able to form a strong panel of scientists (Panel) representing decades of experience in fish habitat relationships along with caucus representatives that have been involved in the water typing process for some time. The panel produced a report which was shared with the stakeholder representatives prior to delivery to the Board for your August 9th 2017 meeting. After the Panel's presentation at the August meeting, the Board passed four key motions important for this work.

Motion 1

The first adopted motion resulted in the delay of accepting PHB recommendations until the Feb February 2018 Board meeting. This motion specifically focused upon providing time for the Panel to gather, analyze, and incorporate eastern Washington appropriate PHBs, provide transparency by making the data used by the Panel available to the public (as well as the QA/QC methods) , and to build more understanding to Board members, caucuses, and the public around the report.

To meet the objectives of the motion, the Panel gathered representative samples of data from water type modification forms (WTMFs) statewide and mined those data for information to be used for PHBs. The data was accepted based on completeness of the forms and having adequate information to inform the PHB criteria of channel size, gradient, and barriers (obstacles). The data used for the analysis were published on the Board's website, and the report was sent to the Board on 16 January 2018 in order to give plenty of time for understanding of the recommendations.

The second part of the first motion directed the AMPA to work with the Washington Forest Protection Association (WFPA) to provide documentation of how their initial data used in the July 2017 report were selected and provided to the science panel by September 20, 2017.

The WFPA provided their procedures to the Board at your November meeting in Spokane. The motion called for an addendum to the report that included their methods, but since the Board already received the material from WFPA that seemed to be unnecessary.

Motion 2

The second approved motion directed the AMPA to gather data for eastern Washington and in those areas of western Washington not represented by landowner data provided to the Panel in July 2017 and work with the Panel to incorporate this data into their analyses to determine PHBs. It further stated that the AMPA must work with the Panel to identify the QA/QC criteria for the data and coordinate the compilation of the data from a random sample of existing approved WTMFs or other appropriate sources of data. The Board also directed that all stakeholders needed to be invited to participate in the collation of data, and asked that a progress report be given at the Board's November 2017 meeting.

To accomplish the second motion, the Panel gathered representative samples of WTMFs statewide and invited stakeholders to contribute to data mining. The Panel developed QA/QC procedures for these data and made the data used available to the public. Progress was reported at the November Board meeting as well as through memos to the Board on a monthly basis.

Motion 3

The third adopted motion directed the AMPA to validate the original analyses that resulted in the recommendations included in the PHB report to the Board. This would be accomplished by gathering a random sample of approved western Washington WTMFs and analyze the data, and compare the results to those of the original analyses. This analysis was to be completed for the February 2018 meeting.

This motion has been accomplished through gathering a representative sample from WTMFs from western Washington and analysis contained in the attached report. Tables where western Washington data are analyzed and in graphs were the distribution of data are described are compared to the final dataset used by the Panel.

Motion 4

The fourth motion passed by the Board directed the AMPA to work with the Panel to develop a validation study design and complete ISPR review of the study design to be completed by the

February 2018 meeting. The Board asked that the study be completed within two field seasons and reported to the Board prior to the next field season.

At your November meeting in Spokane I gave you an update on the study and said it will not be ready by February because of the necessity of independent scientific peer-review (ISPR). Additionally, it is the recommendation from the Panel that the study would need to occur over three field seasons to capture the appropriate information to inform seasonal and annual variability across 8 ecoregions statewide.

Additionally, the Board directed the AMPA to work with the Panel to have additional communication with stakeholders and invite input and to hear an operational perspective on the analyses and results of the recommendations for the Board.

This was accomplished through communication with stakeholders at in-person meetings, conference calls, memos, updates at TFW meetings (Board, CMER, and Policy), soliciting feedback directly (written and verbal), and review of the draft report in early December.

In conclusion, the attached report includes recommendations for your consideration with criteria for gradient, stream size, and obstacles (in place of barriers). These recommendations are based upon data analysis, scientific publications, and experience. As noted in the report, the data that were used originated in WTMFs which were not designed for this expressed purpose and have some limitations. That being said, the Panel felt these data were the best available source of information and provide important objective insight into capturing appropriate fish habitat in the context of identifying a location in which to start a protocol survey to look for fish and to aid in determining an objective point in demarking the Type F/N regulatory break.

Peer-reviewed and gray literature, and personal interviews from experts in water typing were used in combination with data for consideration of recommendations in this report. The Panel's selection of what was most relevant for this exercise is described in the report. The expertise of the Panel was crucial in analyzing the results of the data analysis, considering the relevant literature, and most importantly using experience to interpret the results.

After careful consideration and extensive discussion, the Panel recommends four options for western Washington and two for eastern Washington be used as PHB criterion for application in the FHAM. These criteria would be used to identify a location upstream of known fish waters to initiate a protocol survey and include:

Western Washington:

1. 10% gradient along with a bankfull width of two feet

2. 15% gradient along with a bankfull width of three feet
3. 15% gradient along with a bankfull width of two feet
4. A change of gradient of 5% along with a reduction in bankfull width of 20%

Eastern Washington:

1. 10% gradient along with a bankfull width of two feet
2. 15% gradient along with a bankfull width of three feet

The recommended criteria for obstacles would apply statewide and are as follows:

1. Either a three foot or greater vertical drop or a gradient over 20% and elevation change over the obstacle length that is greater than the upstream bankfull channel width.

Like the report prepared in August 2017, in this report you will see additional evaluations of other potential criteria that were considered by the Panel. In a relative sense, you can see tradeoffs between different options (Tables 4-6) that may be of interest to the Board. Additionally, the Panel discussed one additional approach that is outside of FHAM that may also have merit and may or may not be of interest to the Board.

If you have any questions or comments about the report or the process, please feel free to contact me via e-mail hans.berge@dnr.wa.gov or 360-902-1909.

Review and recommendations for potential fish habitat breaks to begin protocol surveys to determine end of fish habitat on state and private forest lands in Washington State

Report for the Forest Practices Board

January 26, 2018

Submitted by

PHB Science Panel Members

Hans Berge

Pete Bisson

Brian Fransen

Jeff Kershner

Joe Maroney

Phil Roni

Kai Ross

Ray Timm

Patrick Trotter

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List of Acronyms

AMP	Adaptive Management Program
AMPA	Adaptive Management Program Administrator
CMER	Cooperative Monitoring Evaluation and Research
EFH	End of Fish Habitat
EOF	End of Fish
F/N Break	Fish / No fish Break
FHAM	Fish Habitat Assessment Method
LOD	Landowner Dataset
PHB	Potential Habitat Break(s)
Type F	Fish Bearing Streams
Type N	Non-Fish Bearing Streams
UF	Uppermost Fish
WAC	Washington Administrative Code
WTM	Water Type Modification
WTMF	Water Type Modification Form
WTMP	Water Type Modification Point

Executive Summary

As requested by the Forest Practices Board (Board), a science panel (Panel) of experts was convened to develop recommendations for field criteria to define a barrier (obstacle) or potential habitat breaks (PHBs) that could be used as a starting point for protocol electrofishing surveys. At the direction of the Board, we (the Science Panel) used three key pieces of information to develop our recommendations including: 1) reviewing available literature and science, 2) analysis of available data on potential habitat breaks from information in existing water type modification forms (WTMFs), and 3) professional opinion of the Science Panel. The Panel also received input from the seven caucuses on earlier drafts of the report and information from other organizations and professionals who conduct the majority of the field work for water type modifications. The analysis of available scientific literature and data from WTMFs indicated that appropriate PHB criteria should include stream gradient, bankfull width, and obstacles (barriers) to fish migration. The Panel developed 15 potential combinations of bankfull width and gradient, and eight different obstacle definitions passage that could be practically and reliably used in the field to define PHB and the initiation of a protocol electrofishing survey. In addition, to minimize bias, we considered whether the inclusion of data from different sources, the statistical analyses we employed, and the collective experience of the Panel could have resulted in a biased outcome in our recommendations.

The data analyses, which were based on a random sample of WTMFs from ecoregions across western and eastern Washington, were used to examine the suitability of the criteria. Although there was a potentially large sample of WTMFs available (>10,000), we found that a relatively small subset of them included adequate measurements of gradient, width, and obstacles. Many of the combinations of criteria examined correctly identified 70 to 96% of end-of-fish points in our WTMF dataset for both eastern and western Washington – the finest level of ecoregion division our analysis could be performed (for sample size reasons). Based on review of scientific literature, analysis of existing WTMFs, and our professional opinion, we recommend the following:

- That the Board select for western Washington one of the top four performing set of PHB criteria for gradient and bankfull channel width, and one of the top two set of criteria for eastern Washington.

- That the Board select the same PHB obstacle (barrier) criteria for eastern and western Washington, which is a 3-ft vertical drop or an abrupt step in the stream channel with at least 20% slope and minimum elevation change greater than or equal to 1 upstream channel width.
- That the PHB criteria for tributaries of Type F waters (laterals) start at the most downstream end of the tributary (the tributary junction) and changes or thresholds associated with PHB criteria be measured upstream from that location.
- That consistent and accurate protocols and forms for recording gradient, channel width, and obstacle information be established.
- That changes in stream gradient and bankfull channel width over at least 20 times the average bankfull width be measured.

Finally, as instructed by the Board, the Panel will now focus on designing a rigorous study to test the proposed criteria and examine whether additional criteria may be useful in different Washington state ecoregions.

Introduction

The Washington State Forest Practices Rules establish standards for timber harvest and associated activities. The Forest Practices Board (Board) is responsible for rule-making and overseeing the implementation of Forest Practice Rules. The rules are intended to use the best available science to protect fish habitat during timber harvesting operations. The effectiveness of these rules is under review by the Adaptive Management Program (AMP) of the Washington Department of Natural Resources.

Water typing is an important part of applying contemporary forest practice rules since prescriptions for riparian areas of Type F (fish bearing) waters are different than those adjacent to Type N (non-fish bearing) waters. The definition for fish habitat is defined in WAC 222-16-010 as "habitat, which is used by fish at any life stage at any time of the year including potential habitat likely to be used by fish, which could be recovered by restoration or management and includes off-channel habitat." Under the "interim" water typing rule (WAC 222-010-031) the practice used to delineate fish habitat has involved the use of either default physical criteria (e.g., 2 feet defined channel within the bankfull width and greater than 20 percent slope) defined in the rule, or protocol surveys (e.g., electrofishing) as described in Board Manual Section 13 (http://file.dnr.wa.gov/publications/fp_board_manual_section13.pdf). The results of identifying fish habitat using criteria in the rule and guidance on survey protocols from Board Manual 13 have been used to update water typing maps to identify statewide regulatory breaks for applying appropriate forest practice rules (can be found here: http://www.dnr.wa.gov/forest-practices-water-typing).

Establishing a permanent water typing rule has been a priority of the Board since the adoption of the "interim" rule in 2001. In February 2014, the Board was presented with positions for a path forward in establishing a permanent water typing rule by the Timber, Fish and Wildlife Policy Committee (Policy). At that time, the Board directed Policy to work on three specific topics where there were some disagreements around a permanent rule. These included: 1) use of electrofishing, 2) a LiDAR[1] based model, and 3) off-channel habitat. By directing the issue back to Policy with more specific guidance, the Board continued following the adaptive management process for resolving a formal dispute.

[1] LIght Detection And Ranging, a geospatially referenced terrain map based on remote sensing.

After progress was made on off-channel habitat, protocol survey electrofishing, and the LiDAR based model, Policy focused on the water typing protocol itself. After much discussion of approaches to habitat used and likely to be used following recovery or management actions, it was clear that greater specificity and a scientifically-supported method is necessary to apply criteria across State and private timberlands in Washington.

In response, four of the Forests and Fish caucuses submitted recommendations to Policy for the development of a Fish Habitat Assessment Method (FHAM) to be included in the permanent water typing rule that attempted to capture fish habitat as defined in WAC 222-16-010. The intent of the FHAM is to determine the extent of potential or restorable fish habitat and provide a repeatable and reliable method in determining a specific feature that captures the end of fish habitat otherwise referred to as the regulatory type break, i.e., a potential habitat break (PHB) above which fish would not be expected to occur. In May 2017, Policy recommended the Board adopt the FHAM and work on developing specific criteria for potential habitat breaks to be used in the FHAM. The Board accepted the recommendation in May 2017, and directed the AMP Administrator to assemble group of topical experts to recommend PHB criteria to the Board at their 9 August 2017 meeting. The motion from the Board is as follows: "…determine those elements that would constitute an obstacle and/or PHB…determine those physical, biological, and chemical elements that would individually or in combination constitute a high probability the PHB is coincident with a significant change in habitat including stream size, stream gradient, the interaction of size and gradient and the presence of obstacles that limit accessibility, thus the appropriate point to initiate a protocol [electrofishing] survey". It is important to note that the PHB is not necessarily the F/N break, but rather the first point of potentially unfavorable habitat upstream from the last known fish (end of fish or EOF) and the starting point for protocol survey (underlined for emphasis).

Science Panel Formation and Charge

In June 2017, a group of experts (Panel) in fisheries biology, geomorphology, fish habitat relationships in the forested environment, and water typing was assembled and the team was asked to provide a recommendation to accomplish the Board's motion and develop recommendations for the definition of PHB. In addition, a technical committee of stakeholder representatives was invited to participate in making recommendations to the Panel and review

draft recommendations prior to the report being submitted to the Board. The members of the Panel include Hans Berge, Pete Bisson, Brian Fransen, Jeff Kershner, Joe Maroney, Phil Roni, Kai Ross, Ray Timm, and Pat Trotter. Additional support provided by Kevin Ceder, Heather Gibbs and Howard Haemmerle. Stakeholder representatives include Marty Acker, Steve Barnowe-Meyer, Jerry Big Eagle, Chris Conklin, Caprice Fasano, Jamie Glasgow, Marc Gauthier, Debbie Kay, Lauren MacFarland, Derek Marks, Chris Mendoza, Don Nauer, Ash Roorbach Claudine Reynolds, Scott Swanson, Jason Walter, Lindsey Webb, and Sarah Zaniewski.

This report summarizes the approach, analysis and recommendations of the Science Panel.

Approach

The Science Panel) used three key pieces of information to develop our recommendations including: 1) reviewing available literature and science, 2) analysis of available data on potential habitat breaks from data on existing water type modification forms, and 3) professional opinion of the science panel. We first collected available studies and literature on end of fish and upper most distribution of fish, fish swimming performance, fish passage, fish movement above obstacles, and other relevant literature. Next, we examined available data on potential habitat breaks. And third, we used our professional opinion. Collectively, the science panel has more than 200 years of experience on fish and fish habitat in forested streams of the Pacific Northwest. We also considered information provided by stakeholders and their scientists, and those organizations who do much of the water typing in Washington State.

Potential Habitat Breaks (PHB) Criteria Considered

For PHB criteria to be useful, they should be simple to understand and measure, reduce the use subjective judgment wherever possible, accurately reflect boundaries or changes to potential fish habitat and fish use, and be repeatable in the field. We assumed that PHBs apply to all fishes; however, there is little information on the life history, swimming performance and ability to pass obstacles of non-salmonid fishes. Salmonids comprise the uppermost species in most Washington watersheds (Fransen et al. 2003; Cole et al. 2006) and more is known about

their life histories, swimming performance, ability to pass obstacles to upstream movement, and habitat preferences than other stream-dwelling fishes. Therefore, the initial criteria for setting numerical thresholds for PHBs is based on the ecology and behavior of salmon (*Oncorhynchus spp.*), resident trout (*O. spp.*), and chars (*Salvelinus spp.*) with the assumption that criteria for these species would adequately protect non-salmonid habitats. Differences do exist between the performance capabilities of various salmonid species but those differences are not great, especially when involving small fish in small streams.

We considered a variety of potential PHB attributes, including the physical features of a stream channel, water quality and quantity parameters, and other potential factors that might contribute to measurable habitat breaks. These attributes were evaluated in terms of their simplicity, objectivity, accuracy, and repeatability in the field, as well as the amount and relevance of existing scientific literature pertaining to each attribute. We concluded that it is possible to identify PHBs based on changes or thresholds in stream size, channel gradient, and potential natural obstacles (barriers). Ideally, flow would be used rather than stream size, but given lack of adequate seasonal flow data on almost all potential streams, stream size was included as a surrogate for stream flow. We emphasize that the term obstacles (barriers) refers to channel structures that constitute a complete or nearly complete impediment to upstream fish movement under nearly all flow conditions, but because of the lack of definitive scientific evidence we cannot state with absolute certainty that they are permanent blockages at every possible flow and for every fish species. The three attributes – stream size, channel gradient, and obstacles – satisfied the objectives of simplicity, objectivity, accuracy, and repeatability, can be consistently identified in the field, and could be incorporated into a practical survey protocol. Below we summarize the available scientific literature on these three attributes. This was used to help inform the different combinations of PHB criteria proposed and tested by the Panel.

Review of the literature on stream size, gradient and obstacles

Stream Size

Streams become too small for fish use when they become too narrow, too shallow (or both), for fish to carry out basic life history functions such as respiration and feeding. Feeding area is especially important because salmonids are drift-feeders and need an area large enough to provide sufficient foraging opportunities. Streams that are so small and shallow that respiratory

impairment occurs would be unlikely to hold fish unless they were stranded. In addition, stream channels must possess some type of cover (cobbles, undercut banks, large wood) to provide hiding protection from predators.

The interim rules use a critical threshold for stream size of 2-ft and 3-ft bankfull width for western and eastern Washington, respectively (i.e., streams less than 2-ft or 3-ft wide would be unlikely to support fish use). We are not aware of any data which clearly show that a 2-ft bankfull channel width threshold, in the absence of other criteria such as channel gradient or pool frequency, accurately reflects the boundary of fish distribution in Washington State streams. Fransen et al. (1998) examined basin area and last fish distribution in headwaters streams in western Washington and suggested that a mean annual flow of 1 cfs (estimated from basin area and precipitation) may be the threshold for fish bearing and non-fish bearing waters. For some salmonids, small streams may be preferred rearing environments. Rosenfeld et al. (2011) found that cutthroat trout (*O. clarki*) and coho salmon (*O. kisutch*) achieved their highest densities in streams less than 5 m wide in a survey of small streams in coastal British Columbia. Upstream of the anadromous zone (area accessible to anadromous fish), in the uppermost headwaters, fish densities decrease to the point that density-<u>independent</u> factors, not density-<u>dependent</u> factors, govern life history traits such as recruitment, growth and survival (Elliott 1989a, b; 1993; 1994). There is also research, some quite recent using advanced DNA sequence-based methods, showing that strong selection pressures are at work on uppermost fishes, selecting for traits that favor persistence in these environments and against migrations downstream (Northcote et al. 1970; Elliott 1989a, b; 1993; 1994; Whiteley et al. 2017).

In a comparison of the uppermost limit of fish in 58 logged and unlogged watersheds in the western Cascade Mountains, Latterell et al. (2003) found that lack of pools – an indication of stream shallowness – and decreasing channel width exerted a strong influence over fish absence. They stated (p. 1012) "The likelihood of trout presence declined with increasing channel gradient, decreased pool abundance, and decreased channel width across all sites combined… though trout presence was not related to channel width in unlogged sites." The bankfull width at the limit of trout distribution in the study ranged from 2-16 meters in watersheds with a history of logging, where both pool frequency and residual pool depth ranged over about an order of magnitude at the limit of fish distribution. This study illustrates that, in absolute numbers, the boundary physical conditions between streams capable of supporting fish and streams too small

to support fish can be highly variable. However, Latterell et al. (2003) found that incorporating stream size and gradient into a regression-based model produced a tool capable of predicting fish presence or absence in headwater streams.

Abrupt changes in stream size or a minimum stream size are frequently associated with the upper extent of fish occurrence, often in the absence of other observed influences. Fransen et al. (2005) identified associations between stream junctions and the upper extent of fish use in more than half of 517 sites surveyed. Cooperative Monitoring, Evaluation, and Research (CMER) research in eastern Washington identified the upper extent of fish use and found that there was a low likelihood of upstream fish use across season and year at those locations where small lateral tributary streams intersected larger fish-bearing stream reaches (Cupp 2002; Cole and Lemke 2006; Cole et al. 2006). Similarly, research in western Washington demonstrated high agreement between modeled estimates and field verified measurements of fish occurrence at stream junctions where abrupt changes in stream size occurred (Conrad 2003; Cupp 2005; Fransen 2005). Moreover, stream size is really a surrogate for stream flow, but given that adequate information on daily and seasonal stream flow is unavailable at almost all sites, bankfull channel width provides a useful surrogate.

Channel Gradient

Excessive water velocities are a common factor in locating PHBs in small streams. Habitable channels must possess areas where the current will permit fish to hold without being displaced downstream, and if no microhabitats with suitable velocities occur fish will be absent. Sustainable swimming speed is generally a function of body length. Small trout can swim proportionately faster than large fish on a sustained basis relative to body length (Hawkins and Quinn 1996). The burst speed — the maximum speed a fish can swim for a few seconds — is a function of body length as well and is much higher than the sustained speed. If the water velocity across the entire channel exceeds the physiological capabilities of fish to hold a position or move upstream, a potential habitat break is present at that flow.

The gradient of a channel is typically a limiting factor for upstream movement of fish where water velocities are too high and there are no resting habitats. Measuring current speed at all points in a stream reach is not practical and therefore channel gradient is used as a surrogate for the water velocity to which fish are exposed. Latterell et al. (2003) found that channel

gradients downstream from the last cutthroat trout in western Washington streams ranged from 1-22%, while gradients upstream from the last fish ranged from 6-37%. As with stream size, these results indicate that the threshold for a PHB based on a single attribute such as gradient is highly variable. Microhabitats suitable for fish occupancy can occur in hydraulically complex steep channels, while streams with somewhat lower gradients but simpler hydraulics may not support fish if suitable rearing velocities are absent from the reach.

Channel roughness exerts a strong influence on the distribution of velocities, with streams possessing abundant roughness elements such as cobbles and boulders providing sites favorable for trout occupancy, while streams without such roughness elements (e.g., bedrock dominated channels) provide few if any holding areas. Establishing a fixed gradient threshold for PHBs without knowledge of channel roughness can be problematic. Nevertheless, stream gradient was found by Latterell et al. (2003) to be the most important stream attribute in setting the upstream distribution limit of cutthroat trout, and gradient change featured prominently in a logistic regression model developed by Fransen et al. (2006) for predicting the upstream limit of fish in Washington State. It was also an important controlling variable in our analysis of available data and was considered a useful indicator of current velocity and likely fish use.

Permanent Natural Obstacles (Barriers)

Common natural stream habitat breaks that confront uppermost fish and often impede or completely block movement upstream include vertical drops, steep cascades, bedrock sheets, and bedrock chutes (Hawkins et al. 1993; Figure 1). The ability of fishes to pass obstacles to upstream migration is associated with their swimming and leaping abilities. Some of the critical velocities that limit salmonid passage have been established in the laboratory where hydraulic complexity is lacking from swimming performance tests, and this limitation should be recognized when attempting to established suitable swimming thresholds in the field. Swimming abilities of fishes are usually described in terms of three categories of speed (Watts 1974; Beamish 1978; Bell 1991; Hammer 1995; and many others):

- *Cruising speed* is the speed a fish can sustain essentially indefinitely without fatigue or stress, usually 2–4 body lengths per second for salmonids. This is the speed level used during normal migration or movements through gentle currents or low gradient reaches.

- *Prolonged speed* (sometimes called *sustained speed*) is the speed a fish can maintain for a period of several minutes but usually less than 1 hour before fatiguing, typically 4–7 body lengths per second for salmonids (Bell 1991). This is the speed used when confronted with more robust currents or moderate gradients.
- *Burst speed* is a speed a fish can maintain for only a few seconds without fatigue, typically 8–12 body lengths per second for salmonids, but as high as 14 body lengths per second for adult cutthroat trout. Fish accelerate to burst speed when necessary to ascend the short, swiftest, steepest sections of a stream and to leap obstacles. They also use burst swimming to escape predators and capture prey.

Swimming abilities are influenced by water temperature and by the condition of the fish. Swimming ability generally increases with water temperature up to about the point where the physiological tolerance is exceeded—around 22-23 ºC [72-73 ºF] for most salmonids—and then falls off very rapidly. The better the condition of the fish, the more powerful its swimming performance.

Body form has an important influence on swimming ability of fishes. Juvenile coho salmon have a deep, laterally compressed body form with large median fin area, which is well suited for burst swimming performance but not as efficient for cruising or prolonged swimming (Taylor and McPhail 1985). Small coastal cutthroat trout typical of uppermost headwater-resident populations have a more fusiform and streamlined body form with smaller median fin area (Bisson et al. 1988) which makes them better than juvenile coho at cruising and prolonged speed when compared size-for-size, but somewhat poorer than juvenile coho in burst swimming ability. Hawkins and Quinn (1996) found that juvenile coastal cutthroat trout were poorer in burst swimming ability than juvenile steelhead (*O. mykiss*).

When leaping obstacles, fish come out of the water at burst velocity and move in a parabolic trajectory (Powers and Orsborn 1985). Leaping ability also depends on the fish having sufficient water depth at the point of takeoff to enable them to reach burst velocity. One laboratory study suggested that a water depth at least 1.25 times the height of the obstacle was needed for successful jumping (Stuart 1962). More recently, however, Kondrateiff and Myrick (2006) reported that small brook trout (*S. fontinalis*) (size range 100-150 mm) could jump vertical waterfalls as high as 4.7 times their body length from plunge pools only 0.78 times the depth of the obstacle height, and larger brook trout (size ranges 150-200 mm and 200 mm+) could jump waterfalls 3 to 4 times their body length in height if the plunge pool depth was at least 0.54 times the depth of the obstacle

height. It is likely that under the same condition, small trout of other species could perform as least as well as the brook trout in the Kondrateiff and Myrick (2006) study.

Using the parabola equation of Powers and Orsborn (1985) for leap height, we estimated upstream passage possibility for juvenile coho and cutthroat trout encountering a vertical drop (Table 1). For the juvenile coho, three body lengths were used: 60 mm, 85 mm, and 110 mm (all fork lengths, FL), which span the range of sizes typically attained by sub-yearling coho from mid-June through November. For juvenile coho salmon in this size range, even a 30 cm (~1-ft) vertical drop, if completely spanning the stream, would be an obstacle to upstream movement under low flow conditions. For cutthroat trout, a larger size range was used: 80 mm to 160 mm in 20 mm increments (also FL) to encompass the sizes of trout most often encountered in the uppermost parts of the drainage network. Since juvenile coho body shape is more favorable for quick turning and burst swimming performance (Bisson et al. 1988), we chose the high end of the typical burst speed range (12 body lengths/sec) for this species. For the more fusiform shape of the cutthroat trout, we chose the mid-point of the burst speed range (10 body lengths/sec). Three leap angles were used in the simulations: 40, 60, and 80 degrees. This analysis suggests that even the largest cutthroat trout would have difficulty passing a 1-ft vertical obstacle (Table 1). However, the values shown in the table are certainly not close to the 4.7 body length leap heights reported by Kondratieff and Myrick (2006) for their smallest-size brook trout, suggesting that the vertical obstacle criteria established in laboratory studies are not very accurate when predicting obstacles in the field. While Kondrateiff and Myrick (2006) did not report burst speeds, our estimation of burst speed based on their data coupled with the 80 degree jump angle equation of Orsborn and Powers (1985), suggests a leap height of 2.6 ft for a 150mm (6 in) cutthroat trout.

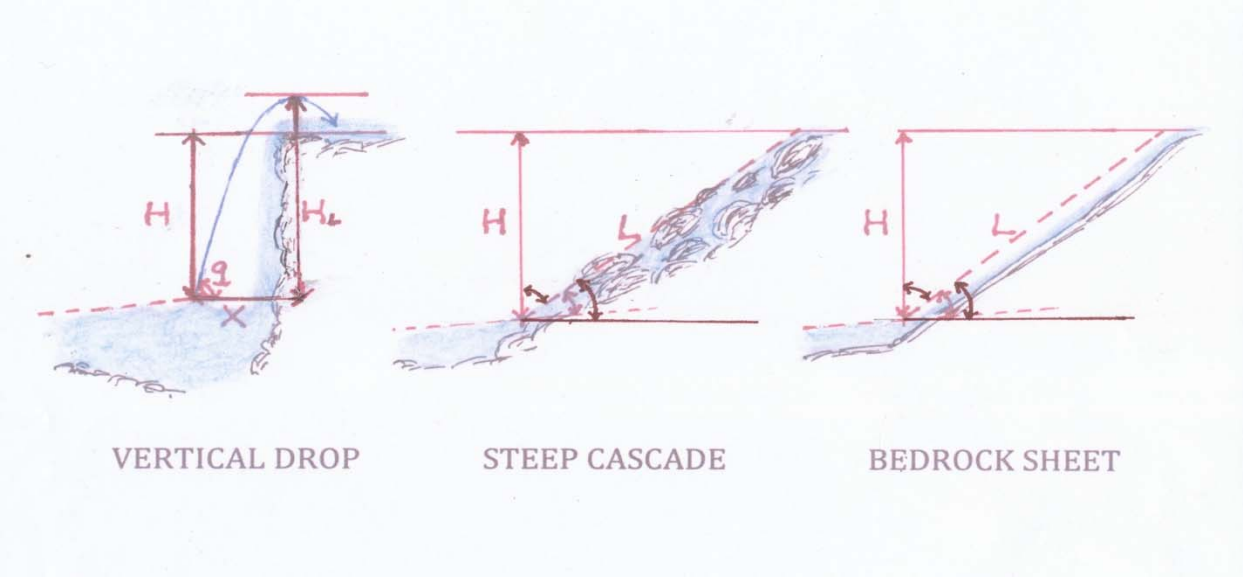

Figure 1. Three types of habitat breaks that could pose obstacles or total blockages to upstream movement of headwater fishes.

Table 1. Estimated maximum leaping height for sub-yearling coho salmon and cutthroat trout based on equation of Orsborn and Powers (1985).

Juvenile Coho Salmon				
Fish Length, ft	Burst speed, ft/sec	Leap Angle 40 degrees Leap Height, ft	60 degrees Leap Height, ft	80 degrees Leap Height, ft
0.20	2.4	0.24	0.27	0.29
0.28	3.4	0.35	0.42	0.46
0.36	4.3	0.48	0.58	0.64
Cutthroat Trout				
0.26	2.6	0.30	0.34	0.36
0.33	3.3	0.40	0.46	0.50
0.39	3.9	0.49	0.57	0.62
0.46	4.6	0.60	0.71	0.78
0.53	5.3	0.71	0.86	0.96

Obstacles to fish passage represent an extreme case of velocity gradients. Research in Eastern Washington found that a vertical drop of 1 m or greater near the upper extent of fish use

was associated with a low likelihood of seasonal upstream fish movement (Cole and Lemke 2005). For small salmonids (<140 mm, 5.5 in) we speculate that a vertical waterfall of 3 ft (90 cm) is often sufficient to impede upstream movement, while cascades or chutes greater than 25% gradient and 50 ft (15 m) long usually exceed burst swimming abilities (Adams et al. 2000; MacNutt et al. 2004) and 50 ft (15 m) long usually exceed burst swimming abilities (Hawkins and Quinn 1996; Adams et al. 22000; MacNutt et al. 2004). Furthermore, a pool of sufficient depth must be present at the base of the falls for fish to attain sufficient jumping speed to achieve successful jump height. We emphasize that these values are highly speculative and are based on a combination of laboratory and field investigations. Further research on obstacles and barriers to fish movement in small streams is warranted. Seasonal flow changes can affect the ability of channel attributes to block upstream fish movement. In general, fish undertake directed movements in response to life cycle needs (e.g., reproduction) or to travel to feeding or wintering habitats (Northcote 1978). It is also possible that fish may move upstream in small streams to reach cooler water during warm summer months. Movements often occur at intermediate flows that happen when the stream hydrograph is rising or falling. Stream-dwelling salmonids tend to avoid long-range (> 0.5 km) upstream movements when flows are very high or very low.

Determining that an obstacle in a stream represents a potential barrier can lead to error when surveys are conducted during extreme base flow conditions. At intermediate flows, water depth is greater and conditions for passage can be more favorable. Higher flows can also inundate areas along the edge of the stream that may offer passage without having to jump a waterfall or negotiate a cascade. For this reason, care should be exercised before classifying an obstacle as a potential barrier without some estimation of how the stream would appear at intermediate flow conditions.

Compilation of Available Data

Initial data collation and filtering in July 2017

To assist with determining PHB criteria, multiple data sets (primarily Water Type Modification Forms) were initially provided by the caucuses and DNR that included information on the end of fish habitat (EFH). Most of the data were collected to determine, verify, or modify DNR's mapped water typing classifications, and contained descriptions of the uppermost fish

(UF) and EFH points. The data were contributed from multiple sources including landowners, state agencies, tribes, environmental programs, and other sources and contained a variety of measurements used to characterize these points (Table 2). Geographically most of the data sets were from Western Washington (Figure 2). Since these data were not originally collected specifically for the purposes of our analysis, it was critical to review each data set to determine whether they could be used to determine PHB and what types of analysis the data could support. After a careful review, the scientific panel recommended a core set of factors to analyze including gradient, bankfull channel width, the interaction between the two, and the presence of obstacles. Because of the time constraints for the analysis and the delivery of recommended PHB criteria, we initially utilized electronic data sets that were available as of July 20, 2017. While there were potentially thousands of other water type modifications that were available in pdf format, the logistical issues with scanning forms and making them compatible with the electronic data would have required too much time for them to be useful in this initial analysis.

Table 2. Available data sets as of July 20, 2017 and their Limitations. LF = last fish. EFH = end of fish habitat, BFW = bankfull width. Only the WFPA Landowner Data was determined to be appropriate for purposes of informing PHB protocols.

Data Set Name	Source	Description of data included	Limitations
OlyAB_survey_data_all	Forest Service	Point locations for LF and EFH around the Olympic Peninsula. Upstream and Downstream gradients. BFW at the point.	No measurements of up- and downstream widths
Data set: DNR Watercourses	DNR Open data portal	DNR Hydrography layer. Contains information on water typing for WA streams and rivers.	No Habitat data
seasonal variability sites final Feb10-05_RO21feb2017	Landowners	Point locations for LF and EFH. Up- and downstream gradient, as well as up- and downstream gradient over 300m. Mean wetted width and BFW at the point.	No measurements of up- and downstream widths
WTYP breaks	DNR. GIS tech.	Point locations of water type breaks across WA.	No Habitat data
WTYP Access	DNR	Database of digitized water type modification forms.	No Habitat data

WDFW fish passage	WDFW Web Portal	Web portal detailing fish passage barriers. Emphasis on manmade barriers.	Man-made barriers are not under consideration
WFPA Landowner Example Data Set	Landowners	Compiled land owner water type mod survey data. LF and EFH point descriptions. Contains up- and downstream measurements of gradient and width. Detailed barrier information.	Coarse spatial data (Township Range Section)
Eastside_dc: 02-197 LF Raw Physical Data	Cole et al. 2006	Up and downstream measurements around LF points. Gradient, WW, BFW, and substrate data. Each stream has 6 upstream transects and 6 downstream transects.	Gradient over uniform transect distances. No spatial data.
WFC watertyping data	Wild Fish Conservancy	WFC water typing data. Several files. Detailed information about barriers. Upstream and downstream measurements from points.	No clear indication of EFH points. Gradient reported in ranges over fixed distances (e.g. 3-9%)
Water Typing: WRIA38	DNR	Complete water typing for WRIA 38. Points contain Up and down stream gradient over 100 units	No measurements of up- and downstream widths
Last Fish Model Development	DNR	Model development data. Contains up and downstream Gradient for points. As well as predicted UF and EFH, predicted gradient (up and down stream).	No measurements of up- and downstream widths

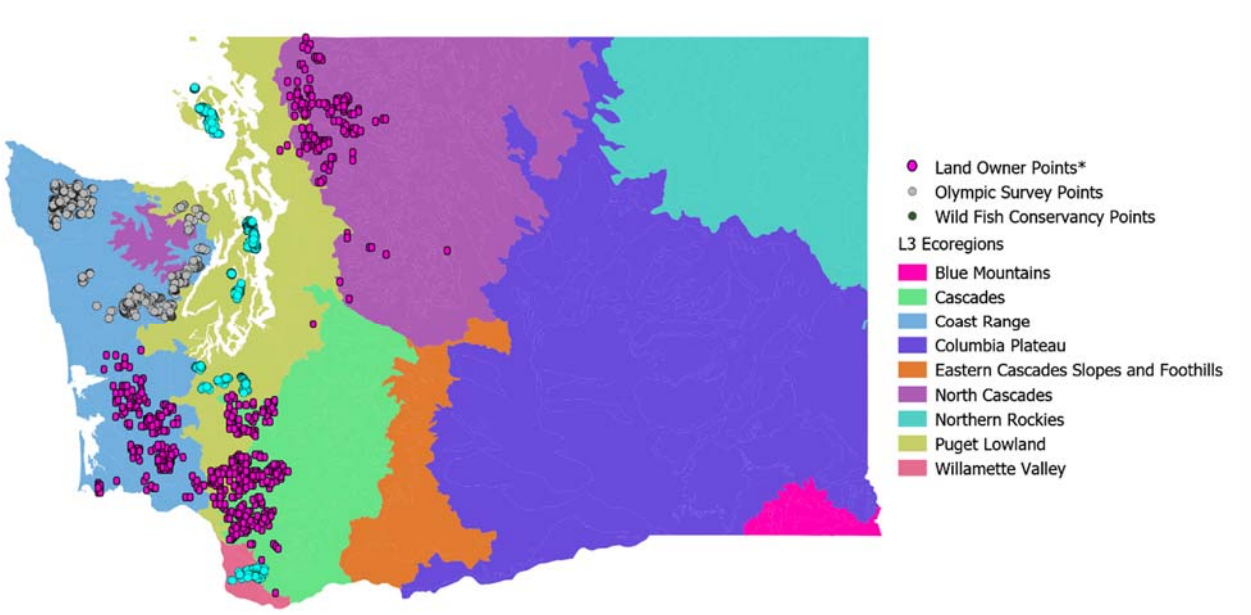

Figure 2. Locations of initial data sets providing end of fish habitat (EFH) data points displayed over level three ecoregions in Washington State. These data sets were screened for consistency to determine the final data set available for analysis.

All data sets in the analysis included measures of stream size and gradient. Additionally, since we were looking for changes or thresholds in habitat conditions that could potentially signal a habitat break, we needed measurements of width (preferably bankfull) and gradient both up- and downstream from the determined EFH point to characterize the change occurring at the point. Thus, data sets were screened to determine whether they included width and gradient up- and downstream from the EFH point. Based on these requirements, only the data provided by the Washington Forest Protection Association representing data from their member companies (Landowner data) that submit water type modification forms to DNR met these criteria. Other data sets contained partially complete data for analytical purposes, but only the Landowner data consistently fulfilled our requirements for quantitative determination of the key parameters in question. The data set also contained information on the last fish point, the primary habitat change factor, and detailed information about obstacles. Moreover, the data set contained 1,560 data points, had broad coverage across western Washington, and contained data for each of the four major western Washington ecoregions. None of the other data sets contained measurements of up- and downstream widths and thus could not be used in the initial exercise (Table 2). The Landowner data set had a number of limitations including but not limited to geographic

coverage, land ownership, and like all the other data sets, was not collected for the express purpose of our analysis.

Additional Data Collection and Revised Analysis

After reviewing our initial analysis and recommendations, the Board raised a number of concerns regarding the Landowner dataset including: the lack of data from eastern Washington, the distribution of the data (clustering of data points with some large geographical gaps) in western Washington, the method of reporting stream width for tributary streams (laterals), and the lack of transparency regarding how the data were collated. At the August 2017 Board meeting, the Board instructed the Adaptive Management Program Administrator (AMPA) to work with the Panel 1) to facilitate the collection of randomly selected data from existing water type modification forms (WTMFs) across eastern and western Washington, 2) identify and apply QA/QC criteria for the data collection, 3) incorporate the data into the analysis and PHB recommendations, and 4) compare the results to the original analysis. Below we describe the process for sampling the existing WTMFs and collecting data, including sampling approach, sample size estimation, data entry, QA/QC and approach to analysis.

PHB Water Type Modification Point Sampling Scheme

Because the PHB criteria will apply state wide as a starting point of protocol electrofishing survey, adequate representation of useable data across ecoregions of the state was necessary to evaluate potential regional differences in PHB criteria. Significant differences may, or may not, be present across ecoregions, but without adequate samples in each ecoregion, the appropriateness of uniform PBH criteria cannot be tested or confirmed. Fortunately, the water type modification points in the WTMF (a single WTMF form often contained multiple WTM points) contain location information, and could be stratified by ecoregion prior to random selection. We felt that EPA level IV ecoregions was the finest resolution upon which the analysis could be conducted. There are nine level IV ecoregions across Washington state, but the Columbia Plateau Ecoregion is largely unforested and no WTMFs exist for the Willamette Ecoregion, leaving seven forested ecoregions (see Figures 2 and 3 for ecoregions; Table 3). Multiple factors have been previously identified as potential habitat break factors including (1) natural obstacles to fish movement such as waterfalls, (2) thresholds (minimum) or changes in

stream size, and (3) thresholds or changes in stream gradient. Because we were interested in defining criteria based on these three metrics, we required adequate samples of all three-potential habitat break factors within each of eight ecoregions. Because physical measurements were often lacking for points in a WTMF, it was necessary to use consecutive sampling to obtain adequate sample sizes. For each ecoregion, we randomly selected a water type modification point (EFH point or F/N break) and located the WTMF that contained the point. We evaluated whether the form was legible, whether the WTMP could be located on the form, and whether the form contained quantitative information on gradient, channel (bankfull or other) or wetted width, or obstacles. If we determined that there were no useful data, we randomly selected another WTMP and located the appropriate WTMF. If the form was legible and contained useful data, we looked for data measurements for stream width, gradient and obstacles. For forms with useable data for a point, we recorded the information on an electronic data form. This process was repeated until adequate sample (50-75) for each of gradient, width and obstacles. Because not all points had data on all three measurements, sample sizes were exceeded for some of the metrics in some ecoregions to assure we had at an adequate sample for each metric (gradient, width and obstacles). Thus, a form could be included if it included data on only one or two of the metrics.

To estimate the number (sample size) of WTMP necessary to characterize PHB in each ecoregion, we used data from the Landowner data set to calculate statistical variance for stream width, gradient and fish obstacles because this data set was most complete with respect to these stream attributes. We used data from the Coast Range ecosystem because the quality of the data was high and we did not have sufficient sample sizes in other areas to inform our estimates. We also felt that these data accurately reflect the variance in other regions. Our estimates indicated that between 50-75 samples would be required to capture the variance present for each metric. More samples were required for the width metrics as they had higher variances in the pilot data we used in the analysis.

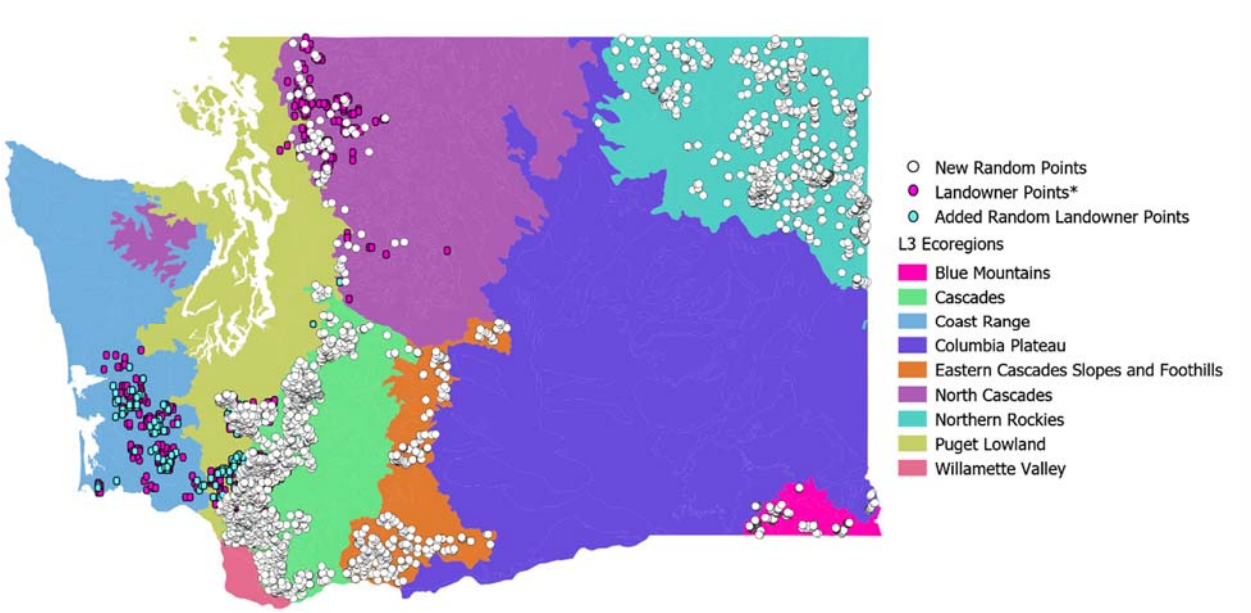

Figure 3. Locations of expanded data (Nov. 2017 random sample) and Landowner data (LOD) used in analysis displayed over EPA level three ecoregions in Washington State. Because we did not have time to draw a random sample of WTMF for all ecoregions in western Washington including the Coast Range and Puget Sound Lowland ecoregions, we drew a random sample of 70 sites from the Landowner data for these two ecoregions and included it with the expanded data set to assure complete coverage for western Washington.

Table 3. Counts of water type modification points assessed by ecoregion and included in analysis. No WTMF exist for the Willamette Valley and Columbia Plateau, and do to time constraints we did not sample the Puget Lowland or Coastal ecoregions in western Washington. However, a random sample of 70 points from each of those two ecoregions was taken from the Landowner data. Thus, we had usable data from a total of 657 and 283 WTMFs for western and eastern Washington, respectively. "Yes" indicates WTMFs that included useable data and were included in analysis. "No" indicates WTMFs with insufficient data on gradient, width or obstacles (barriers). Eastern Washington ecoregions are denoted with an asterisk (*).

Data labeled Useable?	*Blue Mountains	*Eastern Cascades Slopes & Foothills	*Northern Rockies	North Cascades	Cascades	Total
Yes	1	43	192	47	420	**703**
No	152	302	684	34	987	**2,159**
Total	**153**	**345**	**876**	**81**	**1407**	**2,862**

Data entry and QA/QC

Data entry occurred from September through November 19th, 2017. Data processors included DNR and Cramer Fish Science (CFS) staff as well as processing and input help from stakeholders. Specifically, data processors were instructed to include information on physical channel conditions (e.g., gradients, widths) that are a routine part of WTMF. These scanned forms were reviewed and pertinent data were hand entered into a database for analysis. We conducted training with all three groups to assure WTMP selection, review and acceptance or rejection of WTMFs, and data entry were consistent among groups. In addition, we had regular communication and three meetings with the stakeholders so they could provide input on the overall approach and process. Since one of the recommendations from the Board was to explore whether separate criteria for PHBs for ecoregions east of the Cascades were needed, our initial priority was to collect adequate data for ecoregions in eastern Washington to evaluate potential PHB criteria, and then follow a similar process for western Washington to capture WTMP across the state (Figure 3). To reach or nearly reach adequate sample sizes in Northern Rockies, Blue Mountains, and Eastern Cascades Slopes ecoregions, required examining all potential WTM points and forms (i.e., a complete census rather than a random sample). Time constraints prevented obtaining additional random samples from the Coastal and Puget Sound Lowland ecoregions (Table 3). However, because distributions between new expanded data and Landowner data were similar for western Washington, we selected a random sample of 70 sites from the Landowner data for both the Coastal and Puget Sound Lowland ecoregions and included these in the expanded data set.

We randomly selected 5-10% of each data processor group's results to check and evaluate for consistency and accuracy. Overall, the newly processed data had an average error rate around 20%, higher that we initially anticipated. A wide variety of issues were uncovered in the QA/QC process related to transcription errors (mistyped numbers, recorded wrong value, failed to record valid value, etc.). We also performed a less intensive QA/QC procedure on the Landowner data, randomly sampling 50 points (~3% of the total points). The error rate for the Landowner data set was around 10%, considerably less than the expanded randomly sampled data; however, errors were also related to the same data transcription issues. Personnel who had more experience dealing with water type modification forms generally had fewer transcription errors when entering the data.

Data used in this analysis included only the data that each of the data processors evaluated as "useful" and not flagged for more internal review. Not all forms contained data for each of the criteria. Forms that were missing data for one criteria but contained useful data for other criteria were used in the analysis. Because we had a limited number of forms with complete data, we were forced to use as many of the WTMPs as possible to meet our sample size criteria.

Analysis of WTMF Data

After examining the scientific literature, and compiling the available data, the Panel discussed several options for potential criteria for gradient, bankfull width and obstacles to identify appropriate starting points for a protocol electrofishing surveys. We first focused on criteria for channel gradient and width, and investigated whether simple thresholds (e.g. > 20% gradient or < 2 ft (60 cm) bankfull width) or inflection points where gradient or channel width changed abruptly were useful. We discussed multiple options including default thresholds, different combinations of thresholds, minimum channel widths, and different combinations of ratios or differences of upstream and downstream gradient and upstream and downstream channel width including criteria and applied in Cooperative Management and Research (CMER) studies (Cupp 2002; difference in channel width of 30% or more, and a difference in gradient of 5% or more).

To assist with determining the usefulness of different criteria, we used the expanded data set to explore minimum thresholds or changes in gradient and size that occurred at surveyed and concurred EFH points. We report results from the previous analysis of Landowner data for comparison, but did not rely exclusively on prior results in our PHB determination or analysis in this exercise. Because the expanded data were from a random sample, and the Landowner data included more than 1,500 points in western Washington, the expanded data include 46 points in the original Landowner data set. In addition, as noted previously, because we did not have time to draw a random sample of WTMFs for the Coast Range and Puget Sound Lowland ecoregions, we drew a random sample of 70 sites from the Landowner data for these two ecoregions and included this sample with the expanded data. Thus, in total, there were 186 points of the 657 points for western Washington in the expanded data set from the Landowner data set. The expanded data were subdivided into points that had their EFH points attributed to a change in

size and/or gradient as opposed to the points where the EFH was determined by a potential obstacle.

The Panel examined frequency distributions of upstream and downstream measurements, as well as the upstream to downstream ratios and differences for both gradient and channel width (Figures 4, 5, and 6). This illustrated differences between eastern and western Washington streams, though the western Washington data were similar to the Landowner data previously used. Differences between eastern and western Washington may be true differences or reflective of unequal sample size, regional differences in the WTMF concurrence process, or quality of data entered into the WTMF (western Washington WTMFs used a more consistent format than eastern Washington). However, we could not ascertain how these other factors affected the results and based on experience, professional opinion and conversations with those who have completed many of the WTMFs, we conclude that they represent real differences between the two regions.

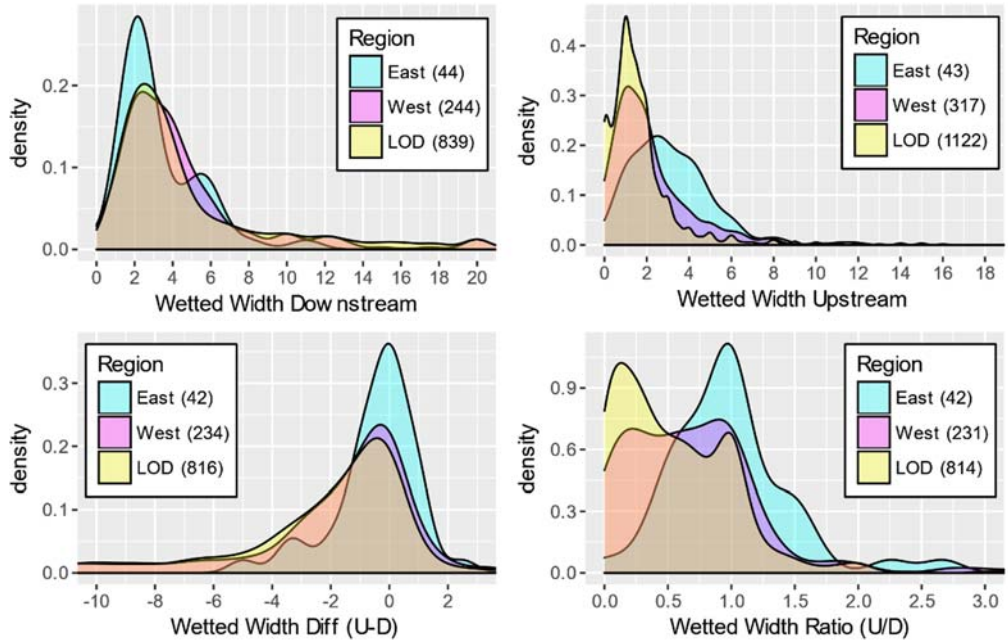

Figure 4. Density plots showing distribution (proportion) of channel width for concurred end of fish habitat (EFH) data points from expanded data. Clockwise from top left: Downstream channel width, upstream channel width, the ratio of upstream width to downstream width.

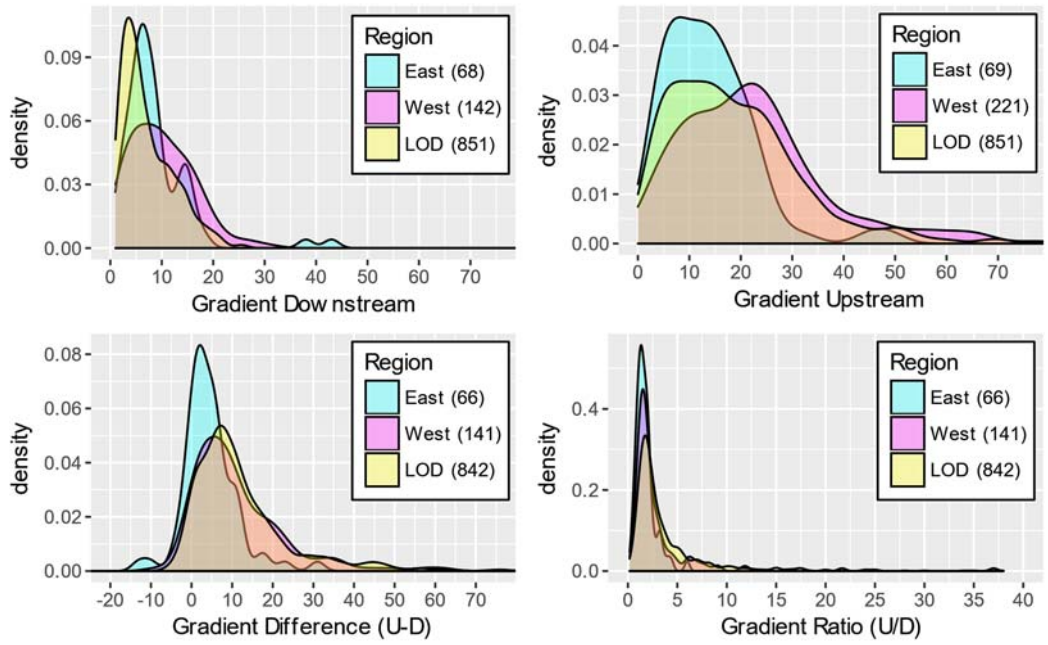

Figure 5. Density plots showing distribution (proportion) of gradient for concurred end of fish habitat data (EFH) for expanded data in eastern and western Washington and LOD (western Washington only). Clockwise from top left: Downstream gradient, upstream gradient, the ratio of upstream gradient to downstream gradient, and the difference between upstream and downstream gradients.

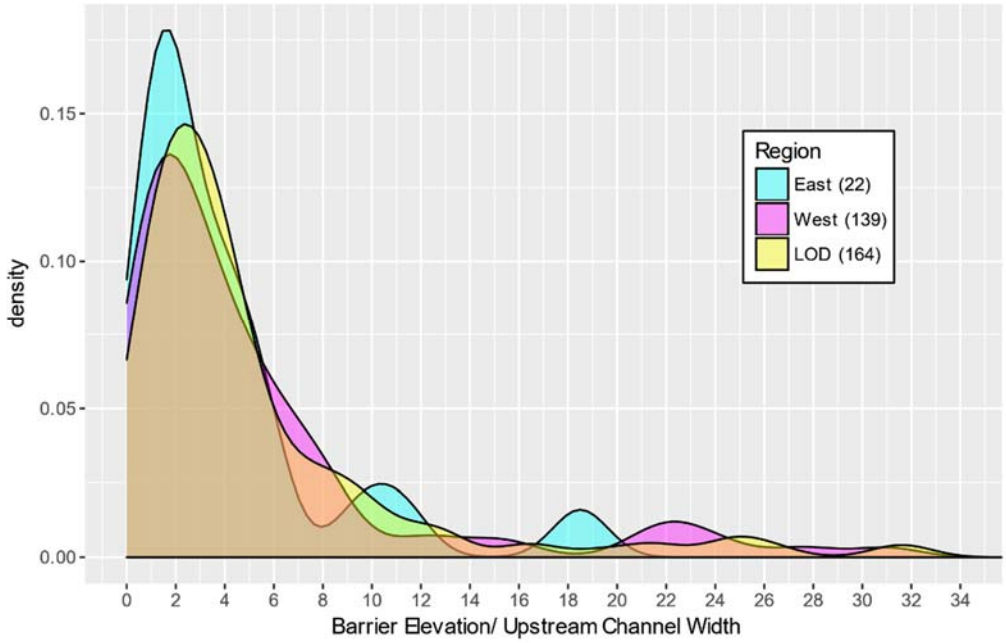

Figure 6. Density plot showing distribution (proportion) of obstacle height for expanded data in eastern and western Washington and LOD (western Washington only).

In these analyses, we observed differences between upstream and downstream stream width (smaller channels upstream) and gradients (steeper upstream), and looked at whether thresholds (minimum width or gradient), differences (upstream - downstream values), or ratios (upstream/downstream values) were informative in describing the Type F/N regulatory break. In addition to frequency distributions, scatter plots of gradient and width metrics were also employed to examine the interaction between the two metrics, and to visualize where proposed thresholds may have occurred within the data for further analysis (Figure 7). Obstacles that could impede or block fish movement were analyzed using a similar process. Surveyed points where the EFH was caused by the presence of a feature were used to test proposed definitions. Little difference was seen among obstacle definitions between the two regions, or expanded and previously used Landowner data sets and obstacle height. Because we had fewer data points for obstacles, more weight was placed on literature review and expert opinion to arrive at proposed definitions.

The expanded data set was used to test the number of surveyed EFH points that would be considered PHBs using various combinations of PHB criteria for channel gradient and width. In the end, we examined 15 different combinations of channel width and gradient and 7 different definitions of non-vertical obstacles. Because of small sample sizes when data were classified by ecoregion, we were only able to stratify by eastern vs. western Washington. A review of WTMF obstacle data showed that obstacles less than 20% gradient were rarely identified as EFHs. Based on this and the available literature, the Panel felt that a key criterion of different obstacle criteria should be a 20% gradient for non-vertical obstacles with the differences in the criteria being the length over which the gradient is measured. While some WTM forms included EOF, most did not and there was not enough data to examine those that were EOF vs. those that were not. In our analysis for western Washington, we include the results of the previous analysis with LOD in the table of results solely for reference and at request of the Board. We relied only on the results of the analysis of the expanded statewide data set to help inform our recommendations.

Results of Data Analysis

We examined 15 potential PHB definitions and against the expanded data for western and eastern Washington to determine, if these criteria were applied, how many of the EFH points would be captured. The percent of EFH points (concurred F/N breaks) captured by the 15

different potential PHB definitions varied from 70 to 96% in western Washington and from 36 to 79% in eastern Washington (Table 4 and 5). When we examine the proportion of points that meet criteria, it is clear that there are multiple PHB criteria combinations that capture 80% or more of the points in the expanded data set (Figure 7). One thing that became clear from the data is that an EFH point is likely to be a PHB if it meets either gradient or width criterion, as often less than ¼ of the points met both criteria simultaneously. Most EFH points met either the gradient or the width criteria (Figure 7).

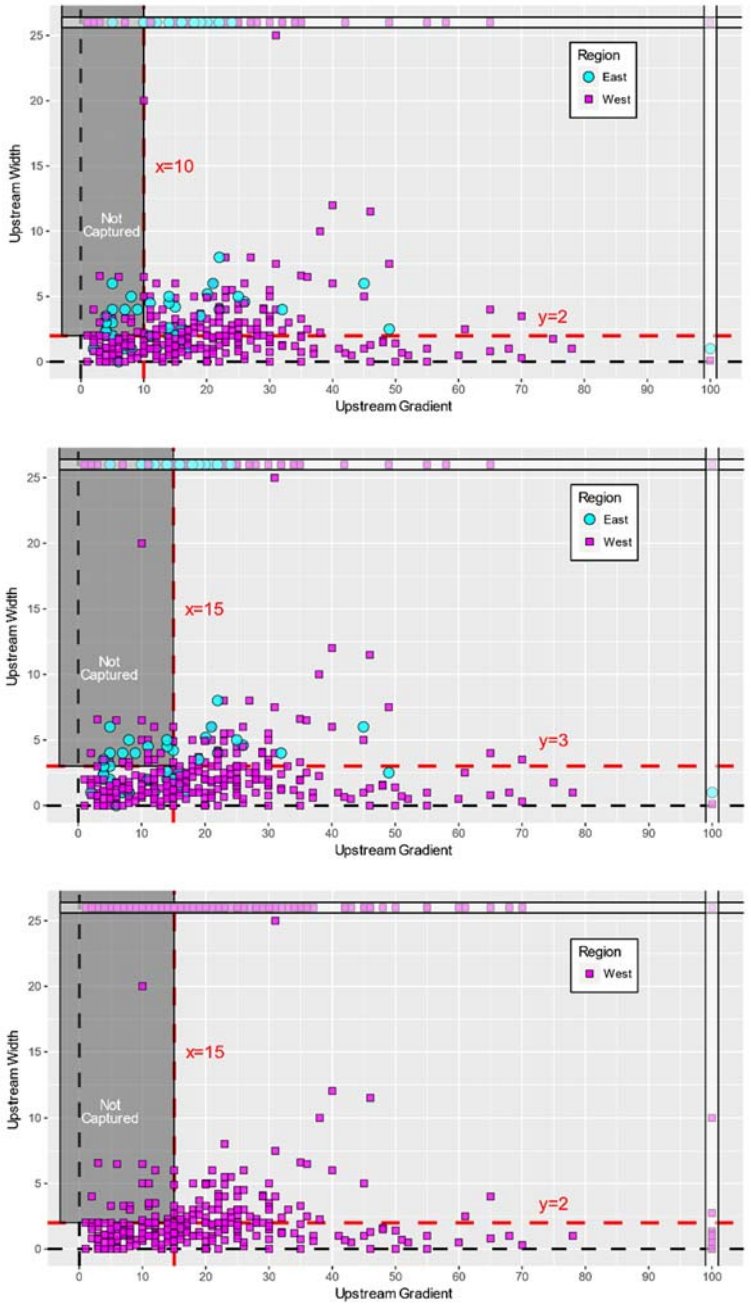

Figure 7. Upstream gradient and upstream channel width for end of fish habitat (EFH) points for recommended PHB criteria 4 (top), 5 (middle), 2 (bottom) (see Table 4 and 5 for criteria). Horizontal and vertical red-dashed lines represent the "2-ft wide and 20% gradient" default physical criteria. Points are categorized by the number of default criteria met with dark grey area outlining points that do not meet either criteria. See Table 4 and 5 for percentage or points captured by criteria. Points where only gradient or only width were reported are at far right and top of graph, respectively.

Table 4. Descriptions of PHB habitat metric sets tested, and their performance when applied to the expanded data for western Washington. Landowner (LOD) data set is provided solely for comparison. The bolded row highlights the Panel's alternative recommendations. Difference indicates downstream width or gradient minus the upstream width or gradient respectively. Ratio indicates the upstream or gradient divided by the downstream width or gradient respectively. Thresholds indicate a discrete value for width or gradient. Percent of EFH points indicates the percent of total points in the data that meet the particular set of criteria tested. n = sample size (number of water type modification points with relevant data).

Test	Gradient Metric	Gradient Threshold	Width Metric	Width Threshold (ft)	Percent of EFH Points LOD	Percent of EFH Points Western Washington (n)
4	**Upstream Threshold**	**10%**	**Upstream Threshold**	**2**	**88%**	**96% (335)**
5	**Upstream Threshold**	**15%**	**Upstream Threshold**	**3**	**92%**	**92% (335)**
2	**Upstream Threshold**	**15%**	**Upstream Threshold**	**2**	**80%**	**91% (335)**
15	**Difference up-down**	**5%**	**Ratio Up/Down**	**0.8**	**95%**	**91% (228)**
10	Difference up-down	5%	Upstream Threshold	2	87%	87% (307)
7	Difference up-down	5%	Ratio Up/Down	0.7	92%	87% (228)
3	Upstream Threshold	20%	Upstream Threshold	2	72%	86% (335)
1	Ratio Up/Down	1.5	Ratio Up/Down	0.75	91%	86% (228)
8	Difference up-down	5% if dsg>=5%	Ratio Up/Down	0.7	87%	82% (228)
11	Difference up-down	5%	Ratio Up/Down	0.5	86%	82% (228)
6	Upstream Threshold	15%	Ratio Up/Down	0.7	89%	80% (335)

9	Difference up-down	5%,10% if DSG<=10%	Ratio Up/Down	0.7	86%	78% (228)
13	Difference up-down	5%	Ratio Up/Down	0.25	80%	76% (228)
12	Upstream Threshold	15%	Ratio Up/Down	0.5	82%	75% (335)
14	Upstream Threshold	15%	Ratio Up/Down	0.25	70%	70% (335)

Table 5. Descriptions of PHB habitat metric sets tested, and their performance when applied to the expanded data for eastern Washington. The bolded row highlights the Panel's alternative recommendations. Difference indicates downstream width or gradient minus the upstream width or gradient respectively. Ratio indicates the upstream or gradient divided by the downstream width or gradient respectively. Thresholds indicate a discrete value for width or gradient. Percent of EFH points captured indicates the proportion of total points in the data that meet the particular set of criteria tested. n = sample size (number of water type modification points with relevant data).

					Percent of EFH Points
Test	Gradient Metric	Gradient Threshold	Width Metric	Width Threshold (ft)	Eastern Washington (n)
4	**Upstream Threshold**	10%	**Upstream Threshold**	**2**	**79% (70)**
5	**Upstream Threshold**	15%	**Upstream Threshold**	**3**	**73% (70)**
1	Ratio Up/Down	1.50	Ratio Up/Down	0.75	73% (67)
10	Difference up-down	5%	Upstream Threshold	2	61% (67)
11	Difference up-down	5%	Ratio Up/Down	0.5	61% (67)
15	Difference up-down	5%	Ratio Up/Down	0.8	61% (67)
2	Upstream Threshold	15%	Upstream Threshold	2	60% (70)

7	Difference up-down	5%	Ratio Up/Down	0.7	60% (67)
6	Upstream Threshold	15%	Ratio Up/Down	0.7	59% (70)
8	Difference up-down	5% if dsg>=5%	Ratio Up/Down	0.7	57% (67)
12	Upstream Threshold	15%	Ratio Up/Down	0.5	51% (70)
3	Upstream Threshold	20%	Upstream Threshold	2	46% (70)
13	Difference up-down	5%	Ratio Up/Down	0.25	43% (67)
14	Upstream Threshold	15%	Ratio Up/Down	0.25	41% (70)
9	Difference up-down	5%,10% if DSG<=10%	Ratio Up/Down	0.7	36% (67)

While it is tempting to select the best performing set of criteria (criteria that captures most EFH points in the data set), it is important for the Board and reader to understand that 1) small differences (1% to 5%) between among PHB definitions are probably not significant, particularly given the limitations and variability in the data; and 2) it is possible to select criteria that would encompass 100% of PHB points in dataset, but they would not be useful as PHB criteria because they could lead to stream mis-classification. For example, in an extreme case, one could set the upstream gradient and width at 0 and capture all the data points, but this is neither practical nor implementable. Similarly, choosing PHB criteria that rely on a single rigidly-defined parameter such as a 2 ft (60 cm) bankfull channel width, would mean once a survey crew reached the last fish they would continue until the average bankfull channel width dropped below 2 ft (60 cm) or met other gradient or obstacle criteria. This could result in increased distance between EOF and the PHB (i.e., moving the F/N break further upstream). Conversely, choosing criteria that would likely be found every few meters, such as a change in bankfull channel width of 10%, would mean the potential PHB could occur just a short distance

above EOF. Thus, it is important that the board considers this when selecting from the PHB criteria alternatives proposed.

Upon reviewing the results of the analysis with the expanded data, the Science Panel discussed which PHB criteria or criterion to recommend. While many Panel members agreed on which criteria performed best in the analyses, the Panel was not unanimous as to which combinations of criteria for gradient and bankfull channel width to recommend. Therefore, we based our recommendations on majority vote of the experts (8 of 9 Panel members). Based on this vote, the Panel recommends that one of the four alternatives with the highest "percent correctly identified" be used for Western Washington and that either of the top two criteria be used for Eastern Washington.

The summary results for multiple tested PHB definitions and thresholds are shown in Tables 4, 5 (Habitat thresholds) and Table 6 (Non-vertical obstacle definitions). The analysis of obstacle data was less clear than for gradient and width, but for non-vertical obstacles (i.e., waterfalls) the Panel thought it was crucial for the definition to scale by stream size. This is also consistent with typical habitat survey procedures (e.g., residual pool depth, habitat unit definition). Moreover, comparing definitions that include stream size to simple upstream thresholds shows a strong increase in the number of correctly identified EFH points caused by obstacles.

Table 6. Descriptions of non-vertical obstacle habitat break definitions and their performance when applied to expanded data and previously used Landowner data (western Washington only). The bolded row highlights the Panel's recommendation. While criteria 5 performed slightly better than Criteria 2, the Panel did not recommend it because they did not feel the obstacle length of 5 ft was reasonable. n = sample size (number of water type modification points with relevant data).

Test	Description	LOD	East (n)	West (n)
5	Obstacle gradient over 20% and elevation change over obstacle length is greater than 5 feet (1.5 m).	85%	91 % (55)	88 % (139)
2	**Obstacle gradient over 20% and elevation change over obstacle length is greater than the upstream bankfull channel width.**	**81%**	**91 % (22)**	**83 % (93)**
6	Obstacle gradient over 20% and elevation change over obstacle length is greater than 1.5 times the upstream bankfull channel width.	**70%**	77 % (22)	71 % (93)
4	Obstacle gradient over 20% and elevation change over obstacle length is greater than 10 feet (3 m).	57%	58 % (55)	68 % (139)
1	Obstacle gradient over 20% and elevation change over obstacle length is greater than twice the upstream bankfull channel width.	59%	50 % (22)	65 % (93)
7	Obstacle gradient over 20% and elevation change over obstacle length is greater than 15 feet (4.6 m).	35%	42 % (55)	50 % (139)
3	Obstacle gradient over 20% and elevation change over obstacle length is greater than 20 feet (6.1 m).	24%	38 % (55)	35 % (139)

Discussion and Recommendations

Based on the literature, examination of the performance of the metrics using the available data and professional opinion, we propose that the Board select from one of the recommended combinations of criteria for gradient and stream size for western and eastern Washington (Table 4 and 5 bold text). For obstacles, we recommend the same criteria for eastern and western Washington, which defines a potential fish passage barrier as a 3-ft vertical drop or an abrupt step in the stream channel with at least 20% slope and minimum elevation change greater than or equal to 1 upstream bankfull channel width (Table 6). It should be noted that while Criteria 5 in Table 6 appears to correctly identify a larger number of vertical obstacle points than recommended criteria (Criteria 2), the panel did not feel that an obstacle length of 5 ft (1.5 m) was reasonable. Figure 8 provides example of how the criteria would be implemented in the field.

Changes in stream gradient and bankfull channel width decreases should be measured over a distance of 20 times the average bankfull width (Rosgen 1996). For tributaries of Type F waters (laterals) the PHB criteria would start at the most downstream end of the tributary and changes associated with PHB criteria would be measured at or upstream from that location. It is possible that there are differences in PHB criteria among ecoregions, but we did not have enough data to examine this at a resolution finer than eastern vs western Washington. The proposed study to evaluate interim criteria should help develop suitable criteria for different parts of the state or ecoregions with a larger sample sizes for comparison.

Our proposal of these as recommendations for interim PHB criteria was based on multiple factors including the literature, analysis of WTMF data, our professional opinion based on experience, as well as input we received from experts at conducting protocol surveys. First, the literature clearly supports gradient, bankfull channel width, and fish passage obstacles as key factors influencing fish distribution. Other factors such as substrate, geology, channel type, stream flow and others can influence fish distribution, but were deemed impractical in terms of field implementation, repeatability, and availability of data. They should be factors considered in a follow up study to validate PHB criteria. Second, our testing and refining of different scenarios against the data we had available – which were by no means perfect or collected specifically to test PHB criteria – indicated that upstream gradient thresholds and bankfull width thresholds generally performed better in identifying concurred F/N break correctly (Table 4 and 5). While

data used in this analysis is imperfect, our findings are similar to those found in the Cole et al. (2006) study funded by the Adaptive Management Program. Cole et al. (2006) found the average stream gradient below terminal boundaries to be 10.7% while the gradient upstream of the boundary averaged 14.6%, supporting the 10% gradient criteria as a PHB. For laterals they were typically found in streams steeper (greater than 10%) and narrower (less than 1 m wetted width).

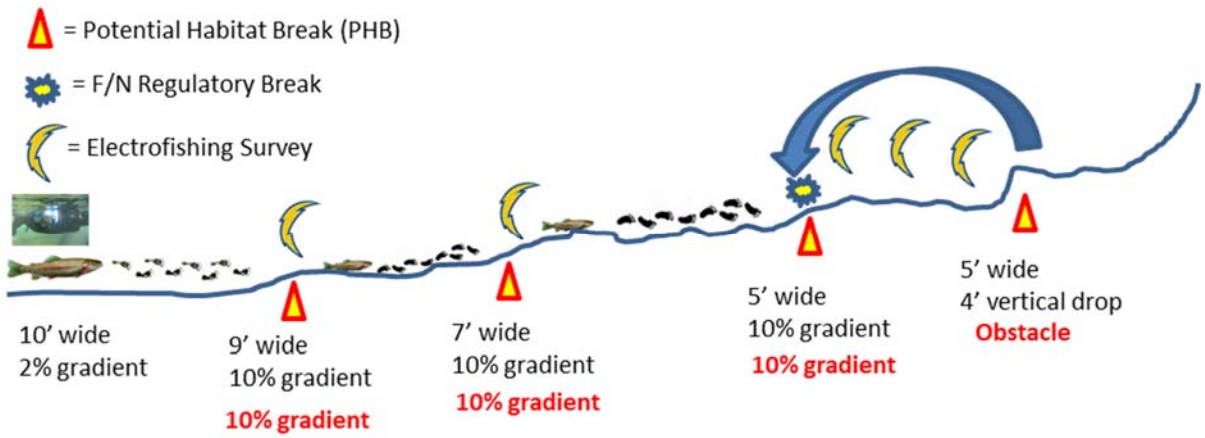

Figure 8. Conceptual example of how the recommendations would apply in the field with the FHAM (fish habitat assessment methodology) using 10 percent gradient, 2 foot bankfull width, and greater than a 3 foot vertical obstacle or greater than or equal to a 20 percent slope over obstacle length greater than the upstream bankfull width. The first step is identifying the EOF (end of fish) location (e.g., snorkeling). Once the EOF is identified, the survey team would begin to measure bankfull width, gradient, and obstacle (barrier) criteria while moving upstream. Once changes were measured that met one of the PHB criterion (red text), the survey team would apply a fish survey (e.g., electrofishing) upstream of the PHB to determine if fish are upstream of the PHB. If sampling yields no fish upstream to the next PHB, then the break would occur at the location where survey commenced. If fish are encountered above any PHB, the process of measuring and moving upstream to the next PHB would repeat until fish are not encountered and the F/N regulatory break is identified.

The expanded data set is an improvement over the Landowner data set in that we either have randomly selected or utilized a complete census of PHB data from WTMFs for each ecoregion, including eastern Washington. Our results from the expanded data set for western Washington and the Landowner data used in our previous analysis were not identical but were very similar. This suggests that while not randomly selected, the Landowner data were representative of data from other WTMF in western Washington. This may be partially explained

by the fact that landowner data was included in the random sample of points in the expanded data set.

Our examination of WTMF, data entry from these forms, and discussion with different entities involved in conducting protocols surveys and submitting WTMF all demonstrated the need for a consistent approach for identifying PHBs, measuring gradient, bankfull channel width, obstacle height and length, and for proper data entry and management. Data in western Washington appeared to have less error, in part because they used a similar approach and data form. In addition, many PHBs appeared to be selected not by strict criteria but because they would make it through the concurrence process. This suggested that the Board needs to establish not only consistent PHBs, but also protocols and forms for recording gradient, bankfull width and obstacle information including measurements both up and downstream of EOF, PHBs and the F/N break. However, the data we used represent the only high-quality data available at the time of our analysis and have largely been reviewed and accepted through a regulatory concurrence process. The expanded data indicated that the proposed criteria correctly identify a larger percentage of EFH (F/N) breaks in the data set than the current interim criteria of 2-ft (60 cm) bankfull width and 20% gradient (Table 6). The proposed criteria also correctly identified a larger percentage of F/N breaks than combinations of criteria we examined. Finally, the proposed interim criteria are based on simple channel gradient and bankfull width measurements upstream from the EOF, and thus should be easy to understand and implement.

The determination of the criteria on PHB obstacles is not intended to supersede current deformable barrier definitions. The definition of an obstacle for the purposes of PHB was based on our assessment of the literature on fish swimming and leaping performance and passage at different types of obstacles (waterfalls, bedrock chutes, and cascades). These data suggested that a drop of 3 ft or a steep chute or cascade of 20% would present a passage obstacle for juvenile and small adult salmonids in small streams. Because the criteria for obstacle length and height should scale to the stream length, we suggested that obstacles be defined by a 20% or higher local gradient over a variable length channel feature, and a change in elevation of more than 1 bankfull channel width. Thus, an obstacle in a 3-ft wide stream would need to encompass an elevation change of at least 3 ft. Scaling the elevation change to channel size is based on our best professional judgement and should be validated during the proposed field study described below.

Recommendations for Interim PHB Criteria

In summary, based on review of existing literature, analysis of existing WTMFs, and our professional opinion, we recommend that:

1. The Board select for western Washington one of the top four performing set of criteria for gradient and bankfull channel width (Table 4), and one of the top two set of criteria for eastern Washington (Table 5).
2. The Board select the same obstacle criteria for eastern and western Washington, which is a 3-ft vertical drop or an abrupt step in the stream channel with at least 20% slope and minimum elevation change greater than or equal to 1 upstream channel width (Table 6).
3. PHB criteria for tributaries of Type F waters (laterals) start at the most downstream end of the tributary (the tributary junction) and changes or thresholds associated with PHB criteria be measured upstream from that location.
4. Consistent and accurate protocols and forms for recording gradient, channel width, and barrier information be established.
5. Changes in stream gradient and bankfull channel width over at least 20 times the average bankfull width be measured (from Rosgen 1996).

Finally, as instructed by the Board, the Panel will now focus on designing a rigorous study to test the proposed criteria and examine whether additional criteria may be useful in different ecoregions of the state.

Additional Considerations

Although the direction from the Board was to identify a set of recommendations for PHB criteria to be used in the FHAM, it is important to note that there are alternative approaches that may be considered for use while the validation study is underway. One such approach is to apply a fixed distance measure upstream of an EOF point. The CMER funded Cole et al. (2006) study in eastern Washington focused upon variability around the EOF point at 308 sites across 10 watersheds. The results of this study demonstrated that the EOF point ranged from -943 m (the EOF moved downstream) to +400 m (EOF upstream), with a mean of -11.7 ± 118 m (SD). While this study was only conducted over two years, it generally supports a pattern from other studies that fish movement is reduced at the upper extent of their distribution (Riley and Fausch 1992,

Hilderbrand and Kershner 2000). Moreover, studies on movement of juvenile anadromous salmonids and resident trout in larger streams show that most fish move less than 100 m during low flow periods (summer and winter) (Kahler et al. 2001; Rodrequez et al. 2002). In the interest of capturing and protecting the upstream extent of fish habitat, these data should be considered. The approach recommended by the panel would be to identify the EOF point and apply a fixed distance to delineate the EFH point until the results of the validation could inform criteria to be used as PHBs.

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M E M O R A N D U M

DATE: January 9, 2018

TO: Forest Practices Board

FROM: Garren Andrews, Compliance Monitoring Program Manager

SUBJECT: Compliance Monitoring Program 2014-2015 Biennial Report, and Independent Scientific Peer Review Synthesis and Assessment

Attached is the 2014-2015 Forest Practices Compliance Monitoring biennial report, and Independent Scientific Peer Review synthesis and assessment.

The 2014-2015 Compliance Monitoring Program biennial report contains data analysis and interpretation, and trend analysis of the nine standard sample prescriptions for the 2014-2015 sampling window. Trend analysis was conducted to detect compliance trends on data collected from 2010-2015.

An Independent Scientific Peer Review was conducted on the 2014-2015 Forest Practices Compliance Monitoring biennial report, and program analytical study design. Major and minor recommendations from the assembled ISPR team are provided in the synthesis and assessment document.

NATURAL RESOURCES

2014-2015 Biennium Forest Practices Compliance Monitoring Report

August 2016

WASHINGTON STATE DEPT OF
NATURAL RESOURCES
PETER GOLDMARK
COMMISSIONER OF PUBLIC LANDS

2014-2015 Biennium Forest Practices Compliance Monitoring Report

August 2016

Garren Andrews
Forest Practices Division
Washington State Department of Natural Resources

Alice Shelly
R2 Resource Consultants, Inc.

Table of Contents

1. Acknowledgments

This biennial report is dedicated to Walt Obermeyer. Walt worked for the Washington State Department of Natural Resources for 29 years and in the Compliance Monitoring Program from 2009 to 2015. Walt will be missed.

The contributions of the following were critical to the completion of this report: the tribal staff and regional staffs of the Washington State Departments of Ecology, Fish and Wildlife, and Natural Resources who performed field reviews in good weather and bad, with special thanks to those who reviewed and entered data, including Todd Olson, Jean Parodi, and John Heimburg. Also thanks to the Forest Practices Division leadership who patiently reviewed various drafts

2. Executive Summary

The Compliance Monitoring Program (CMP) is a key component of the Washington State Department of Natural Resources' (DNR's) Forest Practices Program (FP Program). Compliance monitoring is linked to DNR's responsibility to ensure that operators and landowners are complying with forest practices administrative 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 highlights where there is a need for focus, training, guidance, or clarity.

The CMP reports on real-world 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 biennial CMP report covers data samples collected during the 2014 and 2015 field seasons. Two years are needed to obtain enough data to attain the desired level of statistical precision. The data from the 2014 and 2015 field seasons have been combined to satisfy the desired precision for statistical estimates.

The CMP evaluates compliance with prioritized FP rules considered to have the greatest potential impact on public resources, defined as water, fish, wildlife, and capital improvements of the state. The rule groupings evaluated by compliance monitoring pertain to riparian and wetland areas and to road construction and maintenance.

Sample Design and Methodology

For the purposes of monitoring and statistical analysis, individual FP rules are grouped into categories of similar rules called "prescriptions." Separate samples are chosen for each prescription type monitored. Estimated populations for individual prescriptions are associated with forest practices applications (FPAs) that include forest practices activities, such as timber harvest or road construction. Sample selections for each prescription type are drawn from the FPAs that contain the prescriptions being monitored that year (numbers in parentheses indicate the estimated population of FPAs with the prescription in the 2014-2015 sample): Roads (1,410), Type A&B Wetlands (237), Forested Wetlands (322), No Inner Zone Harvest (NIZH) (737), Desired Future Condition Option 1 (DFC1) (55), Desired Future Condition Option 2 (DFC2) (152), Non-Fish-Bearing Perennial Stream (Np) (929), and Non-Fish-Bearing Seasonal Stream (Ns) (1018).

For this biennial report, 200 prescriptions were sampled. Sample sizes were calculated from a combination of prescription population size, cluster size, and variance. Prescription sample sizes were as follows: Roads (13), Type A & B Wetlands (35), Forested Wetlands (23), No Inner Zone Harvest (25), Desired Future Condition Option 1 (20), Desired Future Condition Option 2 (14), Non-Fish-Bearing Perennial Stream (35), and Non-Fish-Bearing Seasonal Stream (35).

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

- Riparian protection (WAC 222-30-021 and 022)
- Wetland protection (WAC 222-30-020[6] and [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 (e.g., stream width, stream gradient, etc.) are observed to estimate the number of occurrences in which water types recorded on FPAs are different than what is observed on the ground (WAC 222-16-031).

Changes in Study Design

The CMP made significant modifications in the 2014-15 study design to increase precision in statistical estimates for each prescription type observed. Previously, compliance rates were estimated by dividing 100% compliant samples by the total number of samples for each prescription type. The updated study design divides the number of compliant rules by the number of total sampled rules within each prescription type, resulting in an average compliance rate. This change increases statistical precision in results and provides more information to help determine causes of noncompliance associated with rule interpretation and implementation. The added precision helps discern changes in compliance rates over time. The modified design creates flexibility for future sampling to add or remove different prescription types from the sample as needed, while still providing the desired confidence intervals for each prescription type. As a result of rule overlap, the No Inner Zone Harvest and No Outer Zone Harvest prescriptions have been combined.

Trend analysis was incorporated to detect trends in prescription, and individual rule compliance over time. Data collected from 2010-2013 for the standard prescription types were converted to be consistent with current data collection, and analytical protocols. Weighted least squares multivariate linear regression analysis was used to predict general trends in average compliance through time.

Notable Aspects of CMP Samples

- FPAs are randomly selected.
- Conclusions about average compliance are based on a two year 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 data to attain the desired level of statistical precision.
- The CMP establishes sample sizes based on an estimated 95% confidence interval width of +/– 6% on compliance estimates.[1]

[1] A 95% confidence internal of +/– 6% means that if the sample was repeated 20 times, one would expect the population mean (the "true" compliance rate) to fall within the confidence interval 19 out of 20 times.

- CMP results are reported for all the landowners combined.
- The Compliant percentages reported for all sampled prescriptions, except the Haul Route prescription, reflect average compliance for the prescription. Compliance with individual rules within the prescription are summed to calculate the percentage of prescription compliance rates. See section 4 for additional information.
- The Haul Route prescription type follows a different sample design. The Compliant percentages reported for the Haul Routes prescription are overall rates of compliance with FP rules for haul routes (instead of the percentage of the sample compliant). See Section 4 for more information.
- A rule application assessed as compliant is rated either Compliant or Exceeds Rule Requirements. The latter is used when a landowner has implemented higher protection standards than required by FP rules.
- When a prescription is assessed as a deviation, it is rated either Low, Moderate, High or Indeterminate to provide the degree of deviation from rule or FPA requirements.
- Compliance is determined both for compliance of the forest practices activity implementation with FP rules, called "rule compliance," and for compliance of the forest practices activity implementation with what was stated on the FPA, called "FPA compliance."

Findings

Findings from the 2014-2015 sampling season are reported in Sections 5 and 6 of this report.

Water Typing

Supplemental Water Information Forms (SWIFs) were completed for 28 samples due to observed water typing differences between water type documentation on FPAs and on-the-ground physical features. Eleven waters were underclassified, 10 waters were overclassified, 6 waters were indeterminate, and 1 SWIF was completed for a non-water typing issue. Additional relevant data and results for water typing are located in Section 5.

Riparian Management Zones

The DFC1 rate of rule compliance for the 2014-2015 sample period was 94%. The DFC2 rate of rule compliance was 98%. The NIZH rate of rule compliance was 94%. The Np activity rate of rule compliance was 94%. The Ns activity rate of rule compliance was 97%. Additional relevant data and results for water typing are located in Section 5.

Wetland Management Zones

The Type A&B Wetlands rate of rule compliance for the 2014-2015 sample period was 94%. The Forested Wetlands rate of rule compliance was 97%. Additional relevant data and results for water typing are located in Section 5.

Roads

The Roads rate of rule compliance for the 2014-2015 sample period was 98%

The rate of rule compliance for the Haul Routes prescription in the 2014-2015 sample period was 90%. Additional relevant data and results for roads are located in Section 6.

Trend Analysis

Trends of year to year increasing prescription compliance rates were observed for DFC2 (1.5%), NIZH (1.0%), and Roads (1.4%). No statistically-significant trends of decreasing prescription compliance were observed. Additional relevant data and results for water typing are located in Section 7.

Changes Made Based on CMP Feedback

A primary goal of the CMP is to provide feedback from compliance monitoring for the purposes of improving compliance with FP rules. The following are some recent changes made to address issues identified as a result of compliance monitoring: Leave tree, DFC, and RMZ length rule and Forest Practices Board Manual clarifications are currently under review and are targeted for 2017 completion. Rule and Board Manual clarifications have been incorporated into the Forest Practices Board work plan.

3. Introduction

Photo by: Monica McMackin

Compliance monitoring is a component of the Washington State Forest Practices Program. Section 1 gives a brief history leading to the development of the Compliance Monitoring Program and explains key factors and concepts regarding compliance monitoring and the forest practices rules that are monitored.

3.1 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], Title 76.09). This law and its corresponding forest practices rules (FP rules) (Washington Administrative Code [WAC], Title 222) regulate forestry activities on state and private lands in Washington State and are designed to both protect public resources on forestland and ensure that Washington continues to support a viable forest products industry. (WAC 222-16-010 [Public Resources]) Public resources are defined as water, fish, wildlife, and capital improvements of the state or its political subdivisions. 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 DNR, adopts FP rules and approves technical guidance (Forest Practices Board Manual) that assists landowners in implementing FP rules. The FP rules are administered by DNR (with input and consultation from other entities where directed by rule).

A flexible Forest Practices Program (FP Program) was developed to implement the FP Act and rules, because 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 ongoing. 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 that provide information to improve the FP Program include forest practices application (FPA) review and FPA compliance and enforcement. When these components provide feedback suggesting that change is needed to better meet the goals of the FP Act and rules, the Board can adopt new FP rules, modify existing ones, and adopt board manual technical 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 to the Board Manual, and to the FP Program.

One such change was the incorporation of the Compliance Monitoring Program into the FP Program. The 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 based upon best available science. As a result, compliance monitoring for forest practices became a legal requirement. The CMP was promulgated as part of the FP rules in 2001 when the Board adopted FP rules that reflected the protection measures in the Forests and Fish law.

Regarding compliance monitoring, WAC 222-08-160(4) states: "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, with input from other stakeholders, developed a compliance monitoring program design and implemented an initial sampling effort in the spring of that year. 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 CMP website: http://www.dnr.wa.gov/programs-and-services/forest-practices/rule-implementation.The CMP is a key component of a feedback loop intended to improve compliance with the FP 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.

3.2 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 person each from the Department of Ecology and Department of Fish and Wildlife. Additional assistance is provided by tribal biologists and other forest practices staff.

Reports

Field sampling of completed FPAs occurs annually and findings are presented in a biennial report as required by WAC 222-08-160(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 present report is a biennial CMP report and covers data samples collected during the 2014 and 2015 field seasons. The data from the 2014–2015 field seasons has been combined to produce the desired precision for statistical estimates and resulting comprehensive findings, conclusions, and recommendations are detailed in this 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 riparian management zone (DFC1, DFC2, etc.); and forest practices activity types are evaluated based on the function/feature being protected, such as water quality. 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, education, or FP compliance efforts might be needed to increase landowner understanding and 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 2 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 3 ways:

1) The conditions on the ground are in compliance with FP rules but not with the FPA. For example, a landowner/applicant states on the FPA that he or she will leave an RMZ along the entire 1000-foot length of the Np stream in the harvest area, but upon completion of harvest the landowner leaves a buffer along 700 feet of the stream length. The 700-foot RMZ buffer is still in compliance with FP rules because the FP rules do not require the entire length of an Np stream to be buffered. However, the 700-foot buffer 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 deviate from the FP rules. For example, a landowner/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 landowner implements the forest practices activity using the incorrect protection measures, the forest practice has deviated from FP rules but is in compliance with what the landowner 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 FP rules, or "rule compliance." However, understanding deviation from the FPA, or "FPA compliance," can help DNR determine whether improvements should be made in FPA forms, FPA application instructions, or other methods of landowner outreach and education. Information regarding the type of deviation helps to inform the efforts of the FP Program to improve on the ground compliance with FP rules.

Compliance Monitoring Scope Limitations

Compliance monitoring is limited by mandate, and budget, which results in a focused program with a well-defined yet limited scope. Compliance monitoring does not involve the following:

- Focus on individual landowners and compliance specific to those landowners, but rather focuses on 2 overall groups: small and large forest landowners.
- Focus on individual regions and compliance specific to that region, but rather focuses on statewide FP rules and FPAs.
- Track FP rule violations. When field reviewers encounter rule violations, the appropriate DNR regional staff is notified for further review and action.
- Modify water types. Field reviewers do, however, record observed differences between water type documentation on FPAs and on-the-ground physical features. See Section 5.1.

3.3 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 focuses on rules that protect aquatic and riparian species habitat. FP rules that help protect aquatic and riparian species habitat include rules regarding the following:

- Riparian protection
- Wetland protection
- Water typing
- Road construction, maintenance, and abandonment near water
- 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 those that apply to upland habitat. The CMP prioritizes rule sampling based on a forest practices activity's potential to impact public resources.

The following are the CMP's prioritized rules chosen for sampling during the 2014-2015 field seasons.

Standard Sample

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

- Riparian rules — Western Washington and Eastern Washington RMZ rules (WAC 222-30-021 and 022)
- Road construction and maintenance rules (WAC 222-24)
- Wetland rules (WAC 222-30-020[6] and [7]; and WAC 222-24-015)
- Haul routes (WAC 222-24) for sediment delivery

Trend Analysis

For 2010-2015 data, rule compliance was carefully tracked to make sure that the compliance determination was consistently applied in all years. Data were converted to ensure consistent application of compliance determinations across the dataset (i.e. 2010 – 2013 data). Where data were not collected in accordance with current field protocols, were incomplete, or un-convertible, the data were removed from the trend analysis dataset. Data for rules were combined and compared through time within each corresponding prescription type. Trends in average compliance within prescriptions and individual rule compliance are tracked to maintain consistency with current methods.

Emphasis Sample

Other FP rule groups are sampled, as necessary, and are considered to be Emphasis Samples. These other FP rule groups govern activities 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.

Note: Due in part to the CMP study redesign, trend analysis project, and staffing changes, there was no Emphasis Sample conducted for the 2014-15 reporting period.

4. Compliance Monitoring Design and Methodology

Compliance monitoring design was developed to be a consistent and repeatable field-based method to determine if forest practices are conducted in compliance with forest practices rules (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 explains key design and methodology concepts used in the forest practices Compliance Monitoring Program.

4.1 Population and Sample Selection

The population designated for sampling consists of the total number of each prescription type identified on forest practices applications (FPAs) that have completed forest practices activities and expire April 1, 2014, through March 31, 2016. Each FPA states all of the forest practices activities that 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 in a given year. Sample selections for each prescription type are drawn from the FPAs that contain the prescriptions being monitored that year.

Landowner Population Groups

Compliance Monitoring Program (CMP) reports provide riparian and road compliance findings separately for small forest landowners and large forest landowners, in addition to 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. Statistical distributions are only calculated for all landowners combined.

Sample Selection

Populations are grouped by prescriptions (DFC1, DFC2, NIZH, etc.) that have been identified on completed individual FPAs to more accurately analyze the collected field data. Therefore, populations are determined by the frequency of prescriptions that occur as part of completed FPAs.

There are thousands of active (not yet expired) FPAs every year, because the majority of FPAs have 3 years in which to be completed. Each FPA has an expiration date. For the current report, to ensure that all active FPAs had an opportunity to be selected, the populations to be sampled are those FPAs that expire between April 1 of the preceding year and March 31 of the sampling year. For the 2014-15 sample, this included 2,797 FPAs in 2014, and 1,949 FPAs in 2015 (including forest practices notifications; see Glossary). Using the April 1 to March 31 window 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 attempts to visit 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 are 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 the sample FP rule prescription types it includes. This selection process continues through the ordered list of FPAs until the target population/sample size is reached for each prescription type.

All FPAs in the population are ordered by the assigned generated random number and categorized by region. Division staff review FPAs in the random order assigned for monitored activities that are completed. Region staff determine if the activities identified in the FPA have been completed. FPAs that do not contain monitored activities and FPAs that are not complete are discarded from the population. Sample sizes are applied in proportion to region population size for each prescription type.

For each riparian prescription, the population to be sampled consists of FPAs that included that prescription. In some cases, a single FPA contains multiple implementations of the same riparian prescription type. If this is the case, 1 prescription implementation is randomly selected for assessment. Table 1 lists the Standard Sample prescriptions monitored in 2014 and 2015.

For roads prescriptions, compliance with a single rule on a single FPA is the percentage of applications of that road rule that were compliant. Thus, for road rules only, compliance with a single rule can be a number between 0 and 1. For example, if a single rule is applied 6 times on one FPA and is compliant 5 out of 6 times, the compliance is 0.833 instead of 0 or 1 for that road rule on that FPA. The remaining analysis is the same for riparian prescriptions.

Table 1. 2014-2015 Standard Sample Prescriptions Monitored

	Statewide	Western WA Only
Roads	Road Construction and Abandonment	
	Haul Routes	
Harvest	RMZ — Type Ns Prescriptions	
	RMZ — Type Np Prescriptions	
	Wetlands (Type A&B and Forested)	RMZ — Type S or F Inner Zone Harvest DFC1
	RMZ — Type S or F No Inner Zone Harvest	RMZ — Type S or F Inner Zone Harvest DFC2

To be efficient with staff time and funding, haul routes were sampled on a subset of FPAs that were selected for other prescription compliance sampling, rather than from a separately randomized list.

Sample Size and Confidence Values

Standard Sample

In the biennial compliance monitoring design used by the CMP, the Standard Sample uses a significance level of 95%. The CMP set a desired half-width of the 95% confidence interval (CI) at 6%. A 95% CI at +/– 6% means that if the sample was repeated 20 times, one 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 +/– 6% CI for the average compliance rate of each prescription type sampled for the biennium. This sample size is an estimate based on assuming that the variance in compliance rates and average number of applicable rules within each prescription is similar to historical observations. If there is significant variation from the estimates with the actual numbers the following year's sample size may increase to account for the variation. The population of FPAs in any given year is finite. Therefore, the size of the population impacts the variance of compliance rates and, by extension, the width of CIs and the estimated sample sizes. Thus, infrequent prescriptions may 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 that a smaller sample is required than would be for an infinite population.

For this biennial report, variance and cluster size (mean number of rules per prescription) were estimated based on the sample values from 4 years of data (2010–2013) prior to the 2014 sampling, and from 5 years of data (2010-2014) for the 2015 sample. Based on these data and the estimated FPA population size for the biennium, sample sizes were set for the biennium, and 40% of this sample size was applied to 2014. Only 40% of the biennial sample was completed in 2014 due to staffing changes. The remaining 60% of the biennial sample was completed in 2015. The sample sizes were set based on an estimate of the sample sizes required to attain a width of +/– 6% for a 95% CI for the combined 2014–2015 sample. The CI for this estimation was formed by assuming an approximate normal distribution for the average compliance ratio, so the half-width of a 95% CI is the estimated standard error multiplied by an appropriate t-statistic (approximately 2).

As a result of varying population values the CMP updated variance estimates prior to 2015 sampling to include 2014 results in the variance and cluster size estimates. This 2-year approach assumes that there is no change in compliance between the 2 years, so that no bias is introduced by having unbalanced population sampling between the 2 years.

To reach the desired sample size, population sizes for each prescription type are estimated based on the proportion of the entire population viewed (Table 2). Total population sizes for prescription types are estimated. See Appendix A for more information regarding statistical methodologies.

Table 2. 2014-2015 Standard Sample Count by Prescription Type

Geographic Region	Prescription Type		Sample Count	Estimated Population Size of FPAs with the Prescription
Statewide		Road Construction and Abandonment	13	1410
		Haul Routes	27	n/a*
		RMZ — Type Ns Prescriptions	35	1018
		RMZ — Type Np Prescriptions	35	929
		Type A & B Wetlands	35	237
		Forested Wetlands	23	322
		RMZ — Type S or F No Inner Zone Harvest	25	737
Western WA		RMZ — Type S or F Inner Zone Harvest DFC1	20	55
		RMZ — Type S or F Inner Zone Harvest DFC2	14	157

*The Haul Routes prescription does not have an estimated population.

The sample size for haul routes is not set based on statistical precision.

4.2 Field Review and Data Collection

The compliance monitoring field team uses two primary data collection methods of field observations and field measurements. These two methods determine whether the landowner/applicant met the requirements of FP rules while implementing forest practices activities. Field observations are visual assessments that help provide answers to the questions asked on CMP Field Forms. Specific measurements are taken to determine attributes such 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) — Measured for Type S, F, and N waters, except where the stream obviously exceeds or is below a threshold width (i.e., under or over 10 feet in Western Washington; 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 10 measurements.
    - Stream length — Measured using a hip chain. The length is used to determine the stationing for BFW measurements and RMZ width measurements.
    - RMZ and WMZ widths — RMZ widths (and the 3 zones within the RMZ) and WMZ widths are measured using a laser hypsometer to ensure accurate horizontal distances. Lasers with reflectors (held in place) are used to ensure measurement precision. RMZ widths are marked with flagging 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 Roads Field Form. The questions address observed site conditions based on the required management practices in FP rules (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. Haul Route compliance is calculated by distance. Whereas, the compliance rate is the distance compliant divided by the distance sampled.

4.3 Compliance Assessment and Ratings

The CMP utilizes average compliance for a prescription among FPAs rather than the proportion of completely compliant FPAs. Each FPA is analyzed as a cluster of rules within each prescription. FPAs are then grouped according to relevant riparian prescriptions or road activities. Haul Routes, Roads, No Inner Zone Harvest (NIZH), Desired Future Condition Option 1 (DFC1), Desired Future Condition Option 2 (DFC2), Non-Fish-Bearing Perennial Waters, Non-Fish-Bearing Seasonal Waters, Type A&B Wetlands, and Forested Wetlands comprise the evaluated prescriptions. Compliance with individual rules is given a Bernoulli 0/1 result; the prescription compliance is the sum of compliant rules divided by the sum of all rules applied across all FPAs. For example: If a prescription has 17 rules that apply to it (across all sampled FPAs), and 16 of those rules are implemented per rule requirements, then the average compliance for that prescription is 94% (16 compliant rules ÷ 17 total rules = 94%).

Haul Routes

Because haul routes were not sampled in proportion to regional population sizes, a stratified mean ratio compliance estimate was used to estimate statewide compliance. The stratified mean ratio is the ratio of the stratified mean length of compliant haul routes divided by the stratified mean length of total haul routes sampled. Because the sampling has not generally been done in a

strictly random manner, there is potential for bias in the final estimate. Therefore, limiting potential conclusions based on statistical analysis of the Haul Route prescription. Conclusions may be fallaciously attributed to a phenomenon rather that to the method of sampling.

Compliant/Deviation Determination

Compliance percentages disseminated in CMP reports do not necessarily represent the complete picture of compliance with FP rules because there are varying levels of compliance that are difficult to quantify. The terminology describing compliance was changed to better acknowledge and respond to this issue. In past CMP reports, prescriptions have been described as Compliant or Noncompliant. Beginning with the 2012 report, prescriptions were considered Compliant with or a Deviation from FP rules. The former Noncompliant category has been relabeled Deviation to more accurately acknowledge that while a prescription as a whole may deviate from FP rules, several of the FP rules that comprise a prescription may be compliant. Section 4.1 of this report explains that a prescription is 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 DFC2 prescription type (leaving trees closest to Type S or F water in Western Washington) is not a single FP rule but rather a grouping of several rules, some of which are listed below (WAC 22-30-021):

- 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). "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." "Dispersal strategy-riparian leave trees, which means conifer species with a diameter measured at breast height (DBH) of twelve inches (12") or greater, must be left dispersed approximately evenly throughout the outer zone."

These examples are only a few of the FP rules that are part of the DFC2 prescription type. When the DFC2 prescription in a CMP report is shown with a compliance of 98%, this refers to the average compliance of the sampled relevant rules within the DFC2 prescription. The corresponding Deviation category includes any FPAs that are a part of the DFC2 sample that deviated from compliance on at least 1 of the FP rules included in the prescription type.

It is important for readers 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 either Compliant or Exceeds Rule Requirements. Prescriptions that deviate from FP rules are rated either Low, Moderate, or High. When the compliance monitoring field team, due to a variety of circumstances, cannot determine the degree of deviation, it is rated Indeterminate. These ratings help to convey the relative magnitude of deviation from what was required by the relevant rule.

Compliance Ratings and Reasons Descriptions

This section describes five compliance ratings and three reasons for deviation that are applied after the Compliant/Deviation assessment is made, as well as the Indeterminate rating. There are two categories for a Compliant assessment: Compliant and Exceeds Rule Requirements. There are three ratings for a Deviation assessment — Low, Moderate, High — as well as the Indeterminate rating. There are three reasons for a Deviation assessment — Layout, Operational, and Administrative.

Compliant Rating Determinations

The Compliant rating means that an activity meets the requirements of the individual FP rule that is relevant to that activity. By signing and submitting an FPA, a landowner conveys 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 acknowledges that the landowner understands that FP activities must comply with the FP Act and rules.

Implementing this system requires the following assumptions:

- All participants acknowledge that this process relies on professional judgment and does not represent determinations of rule effectiveness.
- There will be no statistical analysis beyond the narrow scope intended.

Compliant Ratings Definitions

- Compliant rating — The activity is compliant with the FP rule.
- Exceeds Rule Requirements (or Exceeds) rating — While implementing their forest practices activities, landowners/applicants chooses to provide more protection than required by FP rules.

Deviation Rating Determinations

The Deviation rating means that an activity does not meet the requirements of the individual FP rule that is relevant to that activity. In order to gauge the magnitude of the deviation and where DNR might focus training efforts to improve compliance, the compliance monitoring field team uses professional judgment to rate deviations. It is important to note that these deviation ratings employ professional judgment and should not be used to excuse activities that violate FP rules or approved FPAs. There are three Deviation categories — Low, Moderate, High — as well as an Indeterminate rating. The following guidelines are used to assist professional judgment when rating the impact of deviation in the field:

- Low Deviation — Minor deviation from requirements of the rule. Examples include:
    - Outer zone has less than the required number of leave trees after harvest.

- Moderate Deviation — Moderate deviation from requirements of the rule. Examples include:
    - Trees harvested from the inner zone are larger than allowed by the Desired Future Condition harvest strategy.
- High Deviation — Major deviation from requirements of the rule. Examples include:
    - No leave trees left in the outer zone.
- Indeterminate — The rule is out of compliance, but the compliance monitoring field team cannot determine the degree of deviation.

Deviation Reasons Determinations

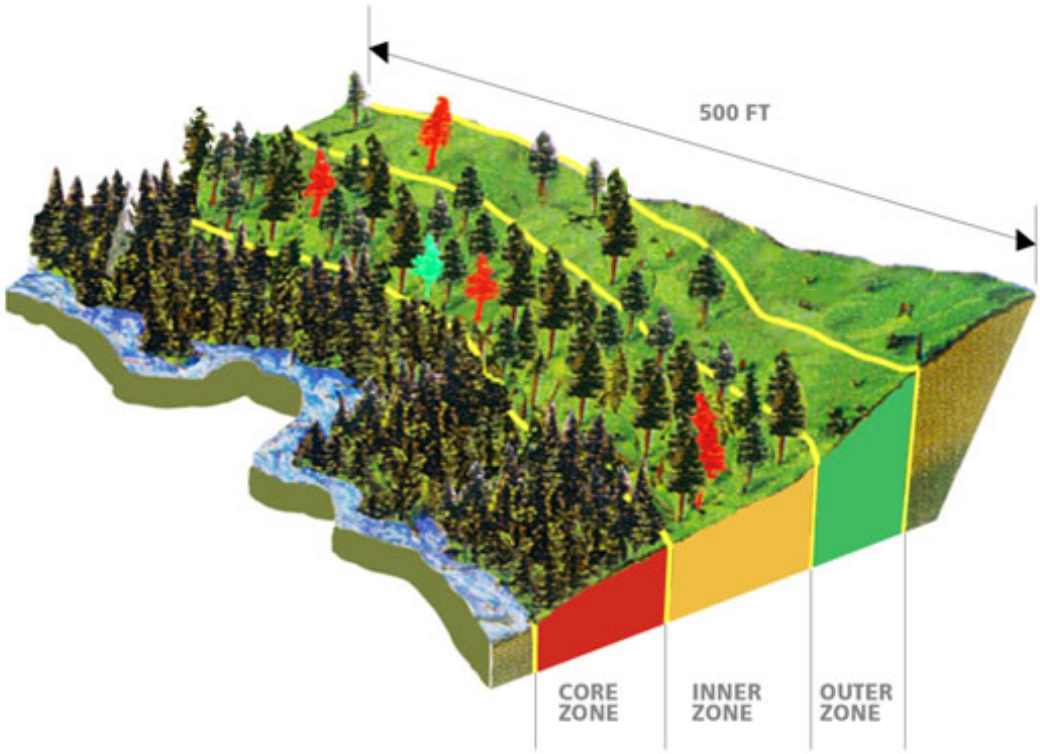
The Deviation reason assessment is determination made by the field team as to a potential cause for non-compliance. It is important to note that these deviation reasons employ professional judgment. There are three Deviation categories — Layout, Operational, and Administrative. The following guidelines are used to assist professional judgment when rating the impact of deviation in the field:

- Layout — The arrangement of the harvest unit did not meet the specifications of the rule. Examples include:
    - A stream meander is unaccounted for in the layout of an RMZ.
- Operational — The timber harvest and related activities process did not follow the arrangement of the harvest unit or associated activity. Examples include:
    - Designated leave trees harvested within a no-cut inner zone.
- Administrative — Information and/or data provided on the Forest Practices Application and associated documents deviates from the conditions observed on the ground. Examples include:
    - An incorrect site class is recorded on an FPA.

The following examples of deviations from FP rules illustrate that there can be a level of compliance for many of the rules included in a prescription type, even when they are assessed as a Deviation. The examples show the process of assigning ratings to the deviation.

Figure 1 illustrates a riparian harvest adjacent to Type F water assessed as a Deviation and rated as Low. A riparian zone harvest is subject to a number of complex FP rules. In this example, the landowner/applicant followed multiple FP rules by typing the stream accurately; measuring the stream width correctly; correctly measuring the core, inner, and outer zone widths; and leaving the core zone intact.

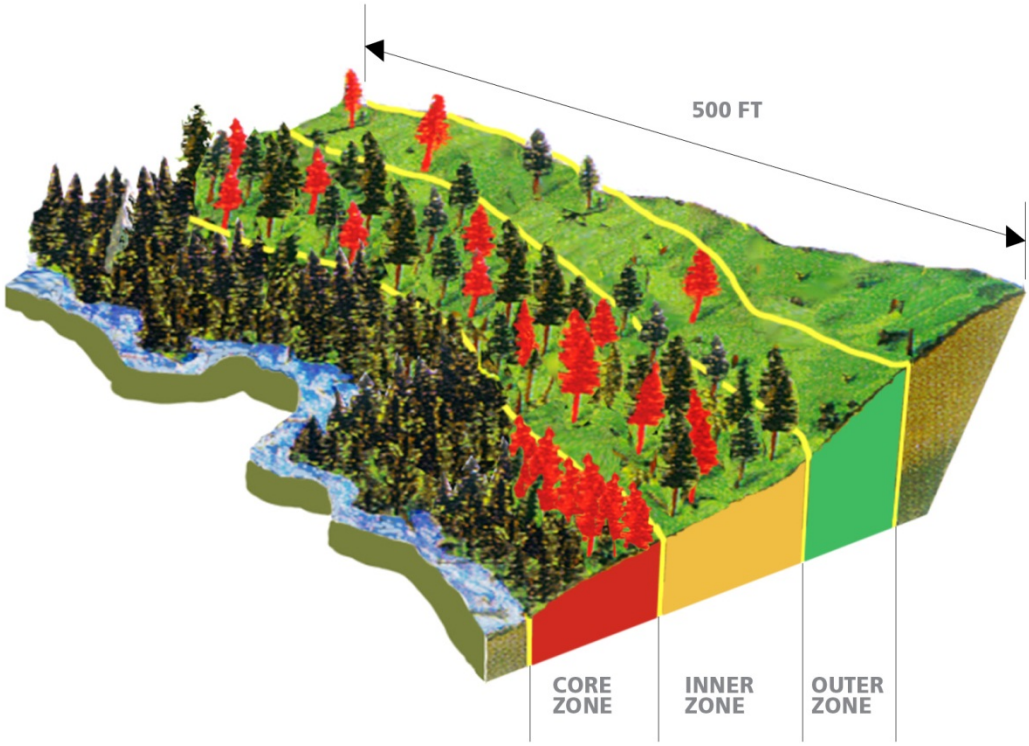
Figure 1. Inner Zone Harvest with Deviation Rated as Low



The red trees in the image represent trees that were required by rule to be left but were harvested. An offsetting factor in representing the average number of trees per acre required is that 1 tree per 500 feet was taken out of the outer zone, 3 trees too many were harvested from the inner zone, and an additional tree that had *not* been required to be left was left in the inner zone (represented in Figure 1 by the lime green tree outline).

In contrast, Figure 2 illustrates an example of inner zone harvest assessed as a Deviation and rated as High, on fish-bearing waters. In this scenario, the landowner/applicant planned a riparian zone harvest and followed the same FP rules as in the example above, except that harvest rules were not followed completely in any of the 3 zones. Each zone would be assessed for individual rule compliance. In this example, 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 High



In Figure 2, 11 trees are missing per 500 feet of the inner zone and 3 trees are missing per 500 feet of the outer zone. Additionally, some harvest occurred in the core zone.

The expectation is for landowners to follow all relevant FP rules. However, there is more to evaluating compliance with FP rules than estimating average compliance for prescription types. The CMP continues to work toward finding better ways to explain a more complete picture of compliance in the reports.

4.4 Design/Methodology Changes

Evaluation of Rule Compliance

An FPA contains a set of rule applications for a particular prescription. As part of the former study design, each FPA was evaluated as either compliant or not compliant for the prescription, based on 100% compliance with all rules in the prescription. The prescription compliance was the number of FPAs that were 100% compliant divided by the total number of FPAs containing the prescription. This can be viewed as a binomial proportion, and confidence intervals were formed under this assumption. This is statistically simple, but the sample sizes required for precise estimates of these proportions were costly and difficult to attain, and the pass/fail aspect

of the compliance assessment did not adequately identify or explain the exact rules being deviated from.

The CMP has integrated a more quantitative estimate of compliance with each rule, with an increase of precision associated with the overall sample estimates. The sampling method remains cluster sampling. There are 2 levels of sampling units: the prescriptions and the rule application. The prescriptions are clusters of rule applications. In the previous method, only 1 assessment was made for each prescription per FPA, so the FPAs were all clusters of size 0 or 1, and the zeros dropped out of the population for the prescription. The changes made are to the methodology of assessing compliance with each prescription, rather than changes to the sampling design. These changes under the current sampling design amount to multiple applications of rules on single FPAs (i.e., the number of rules under prescription A on a single FPA = 0, 1, 2 … up to the total number of rules under prescription), so the FPAs are treated as clusters.

The purpose of the change is to estimate the *average* compliance for a prescription or rule group among FPAs rather than the proportion of completely compliant activities among FPAs. As discussed above, each FPA is a cluster of rule prescriptions, which can be grouped in various ways (prescription or rule group) or evaluated individually. If a single rule is of interest, the compliance proportion for that rule is a simple binomial proportion — FPAs that do not apply the rule drop out of the population. When groups of rules (or prescriptions) are of interest, all FPAs that contain at least 1 of the rules are part of the population (from a random sample). Multiple implementations of a rule on a single FPA are not independent, the FPA is a cluster sample, and each has a different number of rules. The mean or average compliance and the variance of the mean are calculated according to the rules of estimation for cluster samples (Cochran 1963; Scheaffer et al. 1990). Compliance rates calculated using this approach will most likely be higher than the compliance rates previously estimated. For example, if there are many rules in a prescription, bad performance on a single rule will have little effect on overall average compliance. On the other hand, compliance for each individual rule can be evaluated and tracked separately, although precision is not be controlled for individual rule compliance.

Sample Size Estimation

Three independent factors are used to calculate the biennial sample size for each individual prescription: (1) population size; (2) the expected variation within that population; and (3) the desired level of precision in the sampling estimate. The variance of the mean prescription compliance depends on the total number of FPAs that contain the prescription (the population size; because this is a finite population), the sampled number of FPAs that contain the prescription, the average number of rules per prescription applied on each FPA, and the variability of compliance among FPAs. Data from the previous five years of sampling are used to estimate compliance variance for each prescription by year and to approximate sample sizes that should attain reasonable standard errors. Population sizes for each prescription are needed to approximate sample sizes. Because population sizes can vary from year to year, upper bounds for population sizes were used as initial estimates. When good estimates or census data are available before sampling is complete, the population sizes can be updated in the sample size estimation worksheet and the sample sizes can be adjusted. However, it is important to remember that the

variance used for the sample size estimates is also only an estimate. There is no guarantee that the estimated confidence intervals will be the exact width that was projected.

4.5 Compliance Monitoring Challenges

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

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. The CMP resolves the inability to determine statistical variability for average values by assigning an absolute 5% measurement error tolerance. This measurement error tolerance applies for 3 specific measurements: when determining 1) leave tree to edge of bankfull width; 2) buffer widths and lengths or floors within RMZs 3) bankfull width of N and F/S streams. When a landowner's average value is within 5% of the compliance monitoring field team's average value, the landowner's values are considered accurate. If the landowner's average value falls outside the 5% error tolerance, the compliance monitoring field team value is assumed to be correct and the landowner's average value incorrect.

Variation in Natural Conditions

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 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 defined as streams that are perennial non-fish habitat streams. Type F streams are defined as having a gradient equal to or less than 20%. When a stream reach meets the physical criteria for a Type F stream, and lies upstream of a portion of a stream reach that has a gradient greater than 20%, the stream is considered Type F. The only exception is when an approved Water Type Modification Form or supporting Interdisciplinary Team documentation has been submitted endorsing the change of the water type.

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

Forest practices rules (FP rules) are designed to protect aquatic resources and related habitat adjacent to typed waters and wetlands when forest practices activities are carried out. Riparian and wetland areas provide fish, amphibian, and wildlife habitat and protect water quality. A riparian management zone (RMZ) is the area adjacent to Types S, F or Np streams (see definitions below) where trees are retained to provide functions required by aquatic and riparian species, maintain water quality, as well as 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, maintain hydrologic functions as well as shade and nutrients for the wetland. 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 includes 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 ELZ, 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 on 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 on the type and size of the wetland.

Section 5.1 through 5.4 provides FP rule and on-site review descriptions and compliance monitoring findings for the following within the Standard Sample:

- Water type observations
- Western Washington RMZs
- Eastern Washington RMZs
- Statewide wetlands

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

5.1 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 forest practices applications (FPAs). This led to a focus on 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, and 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 orthophotos and were 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://www.dnr.wa.gov/programs-and-services/forest-practices/forest-practices-application-review-system-fpars. 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 by landowners prior to FPA approval.

FP Rules for Water Type

Forest practices water typing rules define 4 types of streams (S, F, Np, and Ns) and three types of wetlands (forested, nonforested Type A [including bogs], and nonforested Type B). The four types of streams are classified hierarchically based on stream function and level of protection required for the stream. The following are the stream types in hierarchical order starting with the highest level (requiring the most protection):

- Type S streams — The highest level of classification, "Shorelines" of the state as designated by the Department of Ecology.
- Type F streams — The second highest level of classification, with fish or specifically defined human uses or both.
- Type Np streams — The next lowest classification in the stream hierarchy, these are non-fish-bearing streams that have a perennial flow of water during a normal rainfall year and include intermittent dry portions of the perennial channel.
- Type Ns streams — The lowest level of classified streams, seasonal non-fish-bearing streams where surface flow is not present year-round.

Wetlands are classified into two broad categories: Forested and Nonforested. Nonforested Wetlands are further divided into Type A and Type B.

- Forested Wetlands — Wetlands that have a crown closure of 30% or more (see Glossary).
- Nonforested Wetlands — Wetlands that have a crown closure of less than 30%.
    - Type A Wetlands — Greater than 0.5 acre in size and 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, and all bogs greater than 0.25 acre.
    - Type B Wetlands — All other nonforested wetlands greater than 0.25 acre.

On-site Review for Statewide Water Types

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. When water is incorrectly underclassified, inadequate riparian protection measures may be applied, which may ultimately impact public resources; conversely, if a water is overclassified, excessive protection may be provided to the detriment of the proponent's objectives for the forest practice activity. 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, Section 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 that 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 that provides opportunity for review by all TFW stakeholder groups.

The compliance monitoring field team observes physical criteria (such as stream width, stream gradient, etc.) to determine if there appear to be differences between water types recorded on FPAs and what is observed on the ground. These observations are made on the same stream reaches and wetlands that have been 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; 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 upstream or downstream of the FPA harvest unit boundary.

The CMP developed the Supplemental Water Information Form (SWIF) to be, used specifically for the purpose of recording potential water type and other water related discrepancies. A SWIF is completed 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. 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), then the information relating to the violation is sent to the appropriate DNR region for follow up. The intent of using SWIFs is to obtain a sense of both the overall magnitude of possible water typing discrepancies on the landscape and the potential incorrect implementation 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 responsibility is on the landowner to ensure that the water types on the FPA have in fact been field validated.

Findings for Statewide Water Types

Water types recorded on a SWIF are further broken down into waters correctly classified, underclassified, overclassified, and indeterminate. The latter three categories are defined as follows:

- Underclassified — 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 system. For example, the FPA depicts a Type Np water that after observation is found to have Type F physical characteristics or observed fish.
- Overclassified — Physical characteristics indicate that the water should have been typed on the FPA and protected on the ground at a lower level of the hierarchical water typing continuum. For example, the FPA inaccurately depicts a Type Ns water that after observation is found to actually be an untyped stream.
- Indeterminate — Waters for which the compliance monitoring field team determines there is not 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. 2014-2015 Water Typing Observation Information

Water Type on FPA	# Waters in Standard Sample	# Waters Recorded on SWIF	SWIF # Waters Underclassified	SWIF # Waters Overclassified	SWIF # Waters Indeterminate
F or S	59	1	*	0	0
Ns	35	8	2	5	1
Np	35	5	3	0	2
Type A Wetlands	17	8	4	2	2
Type B Wetlands	18	5	1	3	1
Forested Wetlands	23	1	1	0	0
Total	187	28	11	10	6

*Compliance Monitoring field protocols stipulate that F or S waters are not to be evaluated for underclassification, as there is no higher order water.

Water typing observations from 2014 and 2015:

Of the 187 sampled waters in 2014 and 2015, 28 samples called for SWIFs due to water discrepancies.
Eleven samples were underclassified, resulting in an underclassification rate of roughly 6%. No protocol surveys or approved Water Type Modification forms were attached to the FPAs with underclassified waters. Of the 11 underclassified waters, 9 were segments that met fish habitat physical characteristics or fish presence was visually observed. Of those, 5 were wetlands where fish presence was observed or were associated with F streams. Three Np streams and 1 Ns stream met fish habitat physical characteristics, respectively. Another underclassified water was typed as Ns, but water flow was observed during the compliance monitoring field visit in September. Additionally, a type B wetland was determined by the DNR wetland specialist to be a bog (treated as an A wetland by FP rules).
Ten samples were overclassified, resulting in an overclassification rate of 5%. Five Ns waters were determined to be wet swales or channels with no connectivity to higher order waters. An A wetland was determined to be non-existent, and 2 type B wetlands were measured to be smaller in area than what was reported on their respective FPAs. The 2 type B wetlands were determined to be a Forested wetland, and a non-forested wetland respectively.
Six samples were indeterminate. Three of the indeterminate observations were for wetlands. Bog indicators were observed by the compliance monitoring field team for a sampled Type B wetland. However, due to physical sampling limitations, a final water typing determination was

not possible. Two of the indeterminate observations were for Np waters. Sampled segments at both sites met fish habitat physical characteristic criteria. At one site the bottom 2-3 stations met fish physical criteria, however, the remaining portion of the segment did not, with no supporting documentation or data a final water typing determination could not be made. At the second site, an approved WTMF was submitted along with the FPA. However, the WTMF was devoid of any typing information and was unclear to which portion of the stream segment it applied to. (Table 3.)

Additionally, 3 SWIFs were completed for non–water typing issues. A SWIF was filled out when the compliance monitoring field team observed a channel migration zone that was unreported on the accompanying application. Rule compliance was unaffected due to an excessively large no-cut buffer left by the landowner. Two SWIFs were completed for overstated stream size (by the applicant) on a Type F water (stream was less than 10 feet wide).

5.2 Statewide Summary for FP Rule Compliance for RMZs, WMZs, and ELZs

Section 5.2 provides 2 summary tables: Table 4 lists the RMZ, WMZ, and ELZ prescriptions sampled in 2014 & 2015; Table 5 shows statewide results for compliance with RMZ and WMZ FP rules. The data and findings for each prescription are discussed in Section 5.3 (Western Washington RMZs) and Section 5.4 (Statewide RMZs, WMZs, and ELZs).

Table 4. RMZ, WMZ, and ELZ Prescriptions Sampled in 2014 & 2015

Western WA	Eastern WA	Statewide
RMZ — Option 1, Thinning from Below RMZ — Option 2, Leaving Trees Closest to Water	No sample unique to Eastern WA	WMZ — Wetlands RMZ — No Inner Zone Harvest ELZ — Type Ns & Np Activities RMZ — Type Np

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. FP rule prescriptions for Type F and N streams can be different for Eastern and Western Washington. However, samples were not separated by Eastern and Western Washington. Wetland rules are the same for Eastern and Western Washington.

The small proportion of small forest landowner FPAs in Table 5 reflects the small proportion of total small forest landowner FPAs within the total FPA population containing the prescriptions assessed.

Table 5. 2014-2015 Compliance with FP Rules for Riparian, Wetland Harvest, and Roads Prescriptions

		Western WA		Statewide					
	Status of Compliance	DFC1	DFC2	No Inner Zone Harvest	Np Activities	Ns Activities	Type A&B Wetlands	Forested Wetlands	Roads
Small Forest Landowners	# Compliant Rules	n/a	n/a	17	2	6	36	11	n/a
	# with Deviation	n/a	n/a	0	0	1	6	0	n/a
	% of Sample Compliant	n/a	n/a	100%	100%	86%	86%	100%	n/a
	Confidence Interval	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Prescriptions Assessed	0	0	4	1	5	12	7	0
Large Forest Landowners	# Compliant Rules	131	98	99	126	53	84	27	81.7
	# with Deviation	8	2	8	8	1	1	1	1.3
	% of Sample Compliant	94%	98%	93%	94%	98%	99%	96%	98%
	Confidence Interval	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Prescriptions Assessed	20	14	21	34	30	23	16	13
All Landowners	# Compliant	131	98	116	128	59	120	38	81.7
	# with Deviation	8	2	8	8	2	7	1	13
	% of Sample Compliant	94%	98%	94%	94%	97%	94%	97%	98%
	Confidence Interval	(91, 97)	(95, 100)	(87, 100)	(89, 99)	(92, 100)	(89, 100)	(92, 100)	(95, 100)
	Prescriptions Assessed	20	14	25	35	35	35	23	13

5.3 Western Washington RMZs

5.3.1 Western WA Type S and F Waters

Section 3.3.1 addresses Type S and F riparian prescriptions: DFC1, Thinning from Below; and DFC2, Leaving Trees Closest to the Water.

On-site Review for Western WA Type S and F Waters

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

- 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 Forms that assess the unique rules directed at individual harvest options.

5.3.1.1 Western WA Type S and F Waters — DFC1, Thinning from Below

Desired Future Condition Option 1 is available if DFC growth modeling results show an available surplus basal area that 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 a trajectory to meet the DFC of 325

square feet of basal area per acre at a stand age of 140 years) then harvest is allowed. When DFC calculations indicate harvest is allowed because the model projects more basal area is available than needed to meet the target basal area in the FP rule, then the smallest diameter trees are allowed to be harvested, followed by the 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 requirements more quickly. The widths of the inner zone and outer zone vary depending on the bankfull width of the stream and the site class. A minimum of 57 conifer trees per acre must be left in the inner zone. A minimum of 20 conifer trees per acre greater than 12 inches (12") 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 Western WA Type S and F Waters — DFC1, Thinning from Below

Desired Future Condition Option 1 is the most complex Type F prescription to implement in terms of the number of requirements to be met. It occurs relatively rarely in the population of FPAs. In the 2014-15 sample, 20 FPAs were selected for review with DFC1 chosen as the harvest option from a total population of 55 FPAs. The resulting DFC1 prescription sample size was 20, and a total of 139 rules were evaluated.

Table 6. 2014-15 Compliance Ratings for Western WA Type S and F Waters — DFC1, Thinning from Below

RMZ Prescription	FP Rule Compliance Ratings						
	Compliant Ratings		Deviation Ratings				
	Exceeds (part of Compliant)	**Compliant**	**Low**	**Moderate**	**Major**	**No Assessed Deviation Rating**	**Indeterminate**
DFC1 (%)	9.9%	94.2%	5.0%	0.7%	0%	0%	0%
DFC1 (Rule Count)	13	131	7	1	0	0	0

Sample size = 20

One hundred thirty one of the sampled 139 rules were compliant for the DFC1 prescription sample, resulting in a 94.2% compliance rate +/- 3%. Of the 20 sites sampled, 14 were 100% compliant and 6 showed deviation from at least 1 FP rule in the prescription type.

Field observations from 2014 and 2015 accounted for 8 non-compliance determinations across 6 sample sites. An unaccounted for meander in a stream course that was approximately 10 feet wide was observed at one site, resulting in a Low Deviation rating, and the reason for non-compliance was determined to be layout. At the second site, 4 required inner zone leave trees were missing from the 12" diameter class, resulting in a Low Deviation rating, and the reason for non-compliance was determined to be a layout issue. The third site had less than the required number of outer zone leave trees, resulting in a Low Deviation rating, and the reason for non-compliance was determined to be operational. At the fourth site, 4 trees removed from a yarding corridor in the core zone were observed, resulting in a Low Deviation rating, and the reason for non-compliance was determined to be operational. At the same site, trees were removed from the inner zone that were larger than allowed by the Desired Future Condition

harvest strategy, resulting in a Low Deviation rating, and the reason for non-compliance was determined to be a result of a layout deficiency. At the fifth site, as a result of a stream meander 2 trees were removed from the core zone, resulting in a Low Deviation rating, and the reason for non-compliance was the result of a layout issue. At the sixth site, as a result of an incorrectly completed Desired Future Condition Worksheet trees were removed from the inner zone that were larger than allowed by the Desired Future Condition harvest strategy, resulting in a Moderate deviation rating, and the reason for non-compliance was determined to be a result of an administrative error. (See table 6.)

Exceeds ratings were assessed for excess Outer Zone leave trees in 9 samples.

5.3.1.2 Western WA Type S and F Waters — DFC2, Leaving Trees Closest to the Water

Desired Future Condition Option 2 only applies to RMZs in site classes I, II, and III on streams that are less than or equal to 10 feet wide and to RMZs in site classes I and II for streams greater than 10 feet wide. For this option, DFC growth modeling results show an available surplus basal area that allows for harvest to take place in the inner zone. Trees are selected for harvest starting from the outermost portion of the inner zone first and then progressively closer to the stream. Twenty conifer trees per acre with a minimum DBH of 12 inches must be left in the harvested area of the inner zone. The widths of the inner zone and outer zone vary depending on the bankfull width of the stream and the site class. For site classes I, II, and III on streams less than or equal to 10 feet, there is a 30-foot no-harvest extension beginning at the outer edge of the core zone. For site classes I and II on streams greater than 10 feet, there is 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 Western WA Type S and F Waters — DFC2, Leaving Trees Closest to the Water

Desired Future Condition Option 2 harvest is easier to implement and is chosen by proponents more frequently than DFC1. In the 2014-15 sample, 14 DFC2 prescriptions were sampled from an estimated population of 157 FPAs. A total of 100 rules were evaluated.

Table 7. 2014-15 Compliance Ratings for Type S and F Waters in Western WA — DFC2, Leaving Trees Closest to the Water

RMZ Prescription	FP Rule Compliance Ratings						
	Compliant Ratings		Deviation Ratings				
	Exceeds (part of Compliant)	Compliant	Low	Moderate	Major	No Assessed Deviation Rating	Indeterminate
DFC2 (%)	22.4%	98%	2%	0%	0%	0%	0%
DFC2 (Rule Count)	22	98	2	0	0	0	0

Sample size = 14

Ninety-eight of the sampled 100 rules were compliant for the DFC2 prescription sample, resulting in a 98% compliance rate +/- 3%. Of the 14 sites sampled, 12 were 100% compliant and 2 showed deviation from at least 1 FP rule in the prescription type.

Field observations from 2014 and 2015 accounted for 2 non-compliance rule determination. At the first site, harvest in the floor zone was observed for the non-compliant sample. 3 harvested stumps were counted, resulting in a Low Deviation rating, and the reason for non-compliance was determined to be operational. At the second site, eight harvested stumps were counted in the floor zone, resulting in a Low Deviation rating, and the reason for non-compliance was determined to be a layout issue. (Table 7.)

Exceeds ratings were the result of leaving more than the required amount of inner, and outer zone leave trees in 14 samples. Additionally, Exceeds ratings were assessed for excess outer portion of floor zone leave trees in 7 samples.

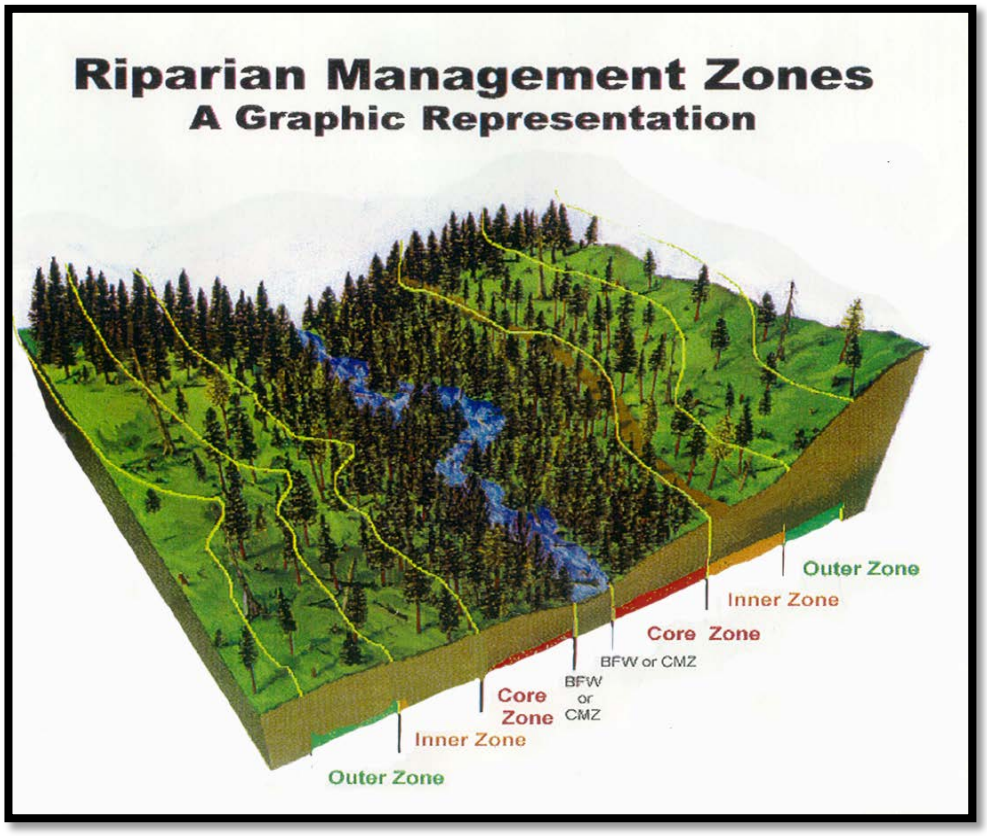
5.4 Statewide RMZs, WMZs, and ELZs

5.4.1 Statewide Typed Waters

Protection measures adjacent to typed water in the state of Washington include protecting channel migration zones (CMZs); establishing riparian management zones (RMZs) 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 equipment limitation zones (ELZs), 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 FP rules for inner and outer zones (see Figure 3).

In Western Washington, no timber harvest or road construction is allowed in the 50-foot core zone on fish-bearing waters (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 to 100 feet, depending on width of the stream and the site class (see Glossary) of the forested stand. Timber harvest of excess trees in the inner zone is only allowed if predetermined stand requirements are met, which are intended to result in a mature riparian forest stand at 140 years of age (called “desired future condition,” or DFC). 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 RMZs



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 ELZs for both Np and Ns waters. An ELZ is a 30-foot-wide area where equipment use is restricted in order to minimize ground and soil disturbance. The ELZ protects stream bank integrity and helps minimize sediment delivery to non-fish-bearing waters that could potentially be routed farther downstream to fish-bearing waters.

In Eastern Washington, riparian management is intended to result in stand conditions that vary over time. Management is designed to mimic local 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 on the DNR site class map, timber habitat type, 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 Habitat Overlay must leave all available shade within 75 feet of the bankfull width or CMZ, depending on which is greater. Np and Ns waters have an ELZ of 30 feet.

5.4.1.1 Statewide Type S and F Waters — No Inner Zone Harvest

For the No Inner Zone Harvest (NIZH) option, DFC results show that existing stands in the combined core and inner zone do not meet stand requirements in western Washington. Therefore, inner zone harvest cannot take place, or sometimes the landowner elects not to harvest in the inner zone for operational or other reasons.

Findings for Statewide Type S and F Water — No Inner Zone Harvest

No Inner Zone Harvest is the most frequently selected harvest strategy adjacent to fish-bearing waters. This harvest strategy occurred on an estimated 737 FPAs in the 2014-15 population. The resulting NIZH prescription sample size was 25, and a total of 124 rules were evaluated.

Table 8. 2014-15 Compliance Ratings for Statewide Type S and F Waters — No Inner Zone Harvest

RMZ Prescription	FP Rule Compliance Ratings						
	Compliant Ratings		Deviation Ratings				
	Exceeds (part of Compliant)	Compliant	Low	Moderate	High	No Assessed Deviation Rating	Indeterminate
No Inner Zone Harvest (%)	8.6%	93.5%	4.0%	0%	1.6%	1%	0%
No Inner Zone Harvest (Rule Count)	10	116	5	0	2	1	0

Sample size = 25

One hundred sixteen of the sampled 124 rules were compliant for the NIZH prescription sample, resulting in a 94% compliance rate +/- 7%. Of the 25 sites sampled, 17 were 100% compliant and 8 showed deviation from at least 1 FP rule in the prescription type.

Field observations from 2014 and 2015 accounted for 8 non-compliance determinations across 5 sample sites. At the first site, an incorrect site class determination was recorded, resulting in a Low deviation rating, and the reason for non-compliance was determined to be administrative. As a result of the incorrectly applied site class, harvest occurred within the inner zone, and no leave trees were left within the outer zone, resulting in a High Deviation rating, and was administrative per the previous explanation. At the second site, 4 merchantable trees were harvested within the inner zone, resulting in a Low deviation rating, and no determination could be made for the reason for non-compliance. At the third site, an incorrect site class determination was recorded, with the reason for non-compliance was determined to be administrative. As a result of the incorrectly applied site class, harvest occurred within the inner zone, 94 trees were removed from the no-cut Inner Zone. These non-compliance determinations resulted in a High deviation rating, and the reason for non-compliance was determined to be administrative. At the fourth site, 2 trees were removed from the no-cut Inner Zone, resulting in a Low deviation rating, and the reason for non-compliance was determined to be operational. At the fifth site, a Channel Migration Zone was observed that was unreported on the FPA resulting in a Low deviation rating, and the reason for non-compliance was determined to be administrative. (Table 8.)

Exceeds ratings were assessed for excess Outer Zone leave trees on 10 samples. Additional outer zone leave trees were left beyond what was required by rule.

5.4.1.2 Statewide Type Np Waters

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 for 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.

In western Washington, the total distance of the 50-foot buffer required along a Type Np stream varies and depends on the length of the Type Np stream from the confluence with the Type S or F stream. At least 50% of a Type Np water's 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 1,000 feet in length, then the minimum percentage of the length of Type Np water to be buffered varies per the table in WAC 222-30-021(2)(b)(vii).

Sensitive sites associated with Type Np streams must also be protected with buffers or harvest restrictions. These include headwater springs or the uppermost point of perennial flow; the intersection of 2 or more Type Np waters; perennially saturated side-slope seeps; perennially saturated headwall seeps; and alluvial fans. No harvest is allowed within alluvial fans.

In eastern Washington, within fifty horizontal feet of the outer edge of bankfull width of the stream, the landowner must identify either a no cut, partial cut and/or clearcut strategy for each unit to be harvested. For partial cut strategies, basal area requirements must be met that are specified for the timber habitat type. For cleat cut strategies, a two-sided no-harvest fifty-foot buffer along the stream reach must be left that is equal in total length to the clearcut portion and meets the upper end of basal area requirements for the respective timber habitat type (WAC 222-30-022(2)(b)(i)&(ii)).

Type Np streams also require a 30-foot-wide ELZ. Equipment use and other forest practices are specifically limited, and mitigation is required if activities expose more than 10% the soil within the ELZ.

On-site Review for Statewide Type Np Waters

Questions asked on the Field Form for Type Np streams differ from those for Type S and F fish-bearing streams. Examples include the following:

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

Findings for Statewide Type Np Waters

Type Np streams were commonly encountered with an estimated 929 FPAs having 1 or more Np streams within their harvest boundaries. The resulting Np prescription sample size was 35, and a total of 136 rules were evaluated.

Table 9. 2014-15 Compliance Ratings for Statewide Type Np Waters

RMZ Prescription	FP Rule Compliance Ratings						
	Compliant Ratings		Deviation Ratings				
	Exceeds (part of Compliant)	**Compliant**	**Low**	**Moderate**	**High**	**No Assessed Deviation Rating**	**Indeterminate**
Np Water (%)	0%	93.4%	2.9%	1.5%	0%	1.5%	0%
Np Water (Rule Count)	0	128	4	2	0	2	0

Sample size = 35

One hundred twenty eight of the sampled 136 rules were compliant for the Type Np prescription sample, resulting in a 93.4% compliance rate +/- 5%. Of the 35 sites sampled, 28 were 100% compliant and 7 showed deviation from at least 1 FP rule in the prescription type.

Field observations from 2014 and 2015 accounted for 8 non-compliance determinations across 7 sites. At the first site, harvest within the buffer of the uppermost point of perennial flow was observed, resulting in a Low Deviation rating, and the reason for non-compliance was determined to be layout. At the second site, the location of the F/N break was inaccurately identified, resulting in the lower 150 feet of the stream being mistyped. The reason for non-compliance was determined to be administrative. At the same site timber harvest was observed within the upper most point of perennial flow no-cut buffer, resulting in a Low Deviation rating, and the reason for non-compliance was determined to be layout. At two additional sites, the sampled stream met fish physical characteristics with no supporting water type modification form or Interdisciplinary Team documentation for Np determination, resulting in the mistyping of the respective sampled segments, the reason for non-compliance was determined to be administrative. No deviation rating is given for inaccurately typed stream segments. At the fifth site, 130 feet of required no-cut buffer was absent, yielding an inadequate buffer length. The resulting deviation rating was Moderate, and the reason for non-compliance was indeterminate. As a result of the inadequate buffer length, harvest was observed within the 50 foot no-cut buffer, leading to a deviation rating of moderate, and the reason for non-compliance was again indeterminate. At the sixth site, a cut stump was observed 46 feet from the edge of Bankfull Width, resulting in a non-compliance determination for harvest within the 50 foot no-cut buffer. The deviation rating was Low, and the reason for non-compliance was operational. At the seventh site, a cut stump was observed 48 feet from the edge of the Upper Most Point of Perennial Flow (UMPPF), resulting in a non-compliance determination for harvest within the 56 foot UMPPF no-cut buffer. The deviation ration was Low, and the reason for non-compliance was operational. (Table 9.)

5.4.1.3 Statewide Type Ns Waters

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

Findings for Statewide Type Ns Waters

Type Ns waters are common, occurring in an estimated 1018 FPAs in the statewide population for the 2014-15 sample. The resulting Ns prescription sample size was 35, and a total of 61 rules were evaluated.

Table 10. 2014-15 Compliance Ratings for Statewide Type Ns Waters

RMZ Prescription	Forest Practices Rule Compliance Ratings						
	Compliant Ratings		Deviation Ratings				
	Exceeds (part of Compliant)	**Compliant**	**Low**	**Moderate**	**High**	**No Assessed Deviation Rating**	**Indeterminate**
Ns Water (%)	0%	96.7%	0%	0%	0%	3.2%	1.6%
Ns Water (Rule Count)	0	59	0	0	0	2	1

Sample size = 35

Fifty-nine of the sampled 61 rules were compliant for the Ns prescription sample, resulting in a 96% compliance rate +/- 5%. Of the 35 sites sampled, 33 were 100% compliant and 2 showed deviation from at least 1 FP rule in the prescription type.

Field observations from 2014 and 2015 accounted for 2 non-compliance determinations across 2 sites. At the first site, the stream was incorrectly typed. The compliance monitoring team observed flowing water in the channel during the month of September of a stream that had been typed Ns by the landowner. The reason for non-compliance was administrative, and no deviation rating is given for inaccurately typed stream segments. At the second site, based on field measurements collected by the Compliance Monitoring field team, the stream segment met fish physical characteristics, resulting in the mistyping of the sampled segment. The reason for non-compliance was determined to be administrative, and no deviation rating is given for inaccurately typed stream segments. The 1 Indeterminate rating resulted from the landowner/applicant's wording on the FPA regarding water typing. (Table 10.)

5.4.2 Statewide Wetland Management Zones

Forest practices wetland rules are the same for Western and Eastern Washington. Wetland management Zones (WMZs) 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, and an average 100-foot WMZ width. Type A&B Wetlands of 0.5 to 5 acres have a minimum 25-foot WMZ width and an average 50-foot WMZ width, while Type B Wetlands less than 0.5 acre and Forested Wetlands require no WMZ. Leave trees are required (by size and number) within the WMZ. There are no leave tree requirements for the Forested Wetlands type. Restrictions also apply regarding the maximum width of openings created by harvesting within the WMZ. Additionally, ground-based harvesting systems shall not be used within the minimum WMZ width without written approval from DNR.

On-site Review for Statewide Wetlands

Protection measures for wetlands depend on the size and type of wetland. The information collected by the compliance monitoring field team varies depending on the type of wetland. Only one of the questions answered by the team is applicable to all wetlands:

- Were the wetlands typed and sized appropriately on the ground and consistent with the FPA?

In addition, for Type A&B Wetlands, the compliance monitoring field team evaluates the following:

- Leave trees in the WMZ for species, number, and size
- 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?
- 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
- 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 landowner/applicant.

5.4.2.1 Statewide Type A&B WMZs

Findings for Type A&B WMZs Statewide

Type A&B Wetlands are estimated to occur on 237 FPAs statewide in the 2014-15 population. The resulting Type A&B Wetlands prescription sample size was 35, and a total of 127 rules were evaluated.

Table 11. 2014-15 Compliance Ratings for Statewide Type A&B WMZs

WMZ Prescription	FP Rule Compliance Ratings						
	Compliant Ratings		Deviation Ratings				
	Exceeds (Part of Compliant)	Compliant	Low	Moderate	High	No Assessed Deviation Rating	Indeterminate
Type A&B (%)	5.0%	94.5%	2.4%	0%	0.8%	2.4%	0.8%
Type A&B (Rule Count)	6	120	3	0	1	3	1

Sample Size = 35

One hundred twenty of the sampled 127 rules were compliant for the Type A&B WMZ sample, resulting in a 94.5% compliance rate +/- 5%. Of the 35 sites sampled, 30 were 100% compliant and 5 showed deviation from at least 1 FP rule in the prescription type.

Field observations from 2014 and 2015 accounted for 7 non-compliance determination across 5 sites. At the first site, a wetland was incorrectly typed. The selected Type A Wetland was determined to be associated with a fish-bearing lake (i.e. Type F water). No deviation rating is given for mistyped wetland segments, and the reason for non-compliance was administrative. At the second site, harvest was observed within the 25' minimum WMZ leading to inadequate leave tree counts in the 6", 12", and 20" diameter classes respectively. A deviation rating of Low was given for each of the 3 non-compliant rules, and the reason for non-compliance was determined to be administrative. At three additional sites, the sampled wetland segments were determined to be fish bearing water, resulting in the mistyping of the three sampled wetland segments. The reason for non-compliance was determined to be administrative, and no deviation rating is given for mistyped wetland segments. The 1 indeterminate rating was a result of a Type A Wetland being potentially associated with a fish-bearing lake. A final determination could not be ascertained due to seasonal water flow conditions, and the associated Type S water in question was located on another landowner's property. (Table 11)

5.4.2.2 Statewide Forested WMZs

Findings for Statewide Forested WMZs

Approximately 322 FPAs statewide contained Forested Wetlands in the 2014-15 sample population. The resulting Forested Wetlands prescription sample size was 23, and a total of 39 rules were evaluated.

Table 12. 2014-15 Compliance Ratings for Statewide Forested WMZs

WMZ Prescription	FP Rule Compliance Ratings						
	Compliant Ratings		Deviation Ratings				
	Exceeds (Part of Compliant)	Compliant	Low	Moderate	High	No Assessed Deviation Rating	Indeterminate
Forested (%)	7.9%	97.4%	0%	0%	2.6%	0%	0%
Forested (Rule Count)	3	38	0	0	1	0	0

Sample size = 23

Thirty-eight of the sampled 39 rules were compliant for the forested WMZ sample, resulting in a 97.4% compliance rate +/- 5%. Of the 23 sites sampled, 22 were 100% compliant and 1 showed deviation from at least 1 FP rule in the prescription type.

Field observations from 2014 and 2015 accounted for 1 non-compliance determination. The 1 noncompliant rule recorded was the result of an incorrectly typed wetland. Fish were observed in the selected Forested Wetland, the reason for non-compliance was determined to be administrative. (Table 12.)

6. Forest Practices Rule Compliance for Roads and Haul Routes

Section 6 provides rule and on-site review descriptions and compliance monitoring findings regarding the Standard Sample for roads and haul routes statewide.

Although Roads prescription sampling follows the same design as riparian sampling, Haul Routes prescription sampling is designed differently. Haul Routes sampling assesses each 0.1 mile segment of forest road for correct design and for construction or maintenance of roads to protect typed waters from sediment delivery. This strategy enables determination of the rate of compliance for the entire haul route specified on the FPA.

A well-designed, located, constructed, and maintained system of forest roads is essential to both forest management and protection of public resources. Washington State forest practices rules — including those for road construction, maintenance, and abandonment and for "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 do the following:

- Provide for fish passage
- Prevent mass wasting
- Limit delivery of sediment and surface runoff to all typed waters
- Avoid capture and redirection of surface water or groundwater
- Divert road runoff to the forest floor
- Provide for the passage of some woody debris
- Protect stream bank stability
- Minimize construction of new roads

- Assure no net loss of wetland function

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

The CMP collects data annually on sites where one or more of the following exists:

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

FP Rules for Statewide Roads and Haul Routes

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

Forest Road Construction

Road construction is composed of 3 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 (defined in the on-site review section, below).

1) Road location — FP rules require that roads be 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 landowner/applicant minimize the number of stream crossings and not locate roads in bogs or within natural drainage channels (except for crossings).
2) Road design — FP rules include road design standards that address construction techniques and water management (WAC 222-24-020). For example, new road construction on side slopes exceeding 60% that 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 needs to be seeded with noninvasive plant species.

Landing Location and Construction

Landings are subject to several FP rules. Landings 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 WMZs or within the bankfull width of any stream or the 100-year flood level of any typed water (WAC 222-24-035).

Type F and N Stream Crossings

Installation, maintenance, and removal of bridges, culverts, and temporary water crossings must follow several FP rules (with technical guidance provided in Forest Practices Board Manual Chapter Section 5). For example, culvert placement must be designed so that the alignment and slope of the culvert parallels the natural flow of the stream and so that placement 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 must be followed (with additional technical guidance provided in Board Manual Chapter Section 3). 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 rules state that roads 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 Statewide Roads and Haul Routes

In order to determine road compliance, the compliance monitoring field team visited FPA sites where forest road construction, landing construction, Type N stream road crossings, abandoned roads, and haul routes are present. The compliance monitoring field team used the Roads Field Form and the Haul Route Field Form to record information onsite. The data recorded on the Roads Field Form and the Haul Route Field Form helped the team determine road compliance for each FPA sampled.

Roads Field Form

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

The 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)
- 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], and [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 guide the systematic assessment of haul routes. The sampling method provides information for reporting the proportion of compliance/deviance, the level of sediment delivery (Table 13), and the cause of the noncompliance (Table 14).

There were five recorded levels of sediment delivery (No Delivery, De Minimis, Low, Medium, and High) used by the team for rating levels of sediment delivery, as well as one decision type (No Consensus). (Table 13.)

Table 13. Haul Route Sediment Delivery Level Categories

Delivery Level	Delivery Level Description
No Delivery	Complete disconnection of sediment delivery to typed water. Considered compliant.
De Minimis	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 1 channel width) only are and not expected to magnify over time given the existing activity.
Medium	Measurable but noncritical 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 go 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, where possible, causes for sediment delivery. The compliance monitoring field team observes and records both primary and secondary causes of sediment delivery. (See Table 14.)

Table 14. Potential Causes of Sediment Delivery

Potential Causes	Cause Description
Faulty cross drainage	Inadequate frequency of or nonfunctioning drainage structures that carry road prism runoff or seepage, allowing sediment delivery to typed water
Inadequate water crossing structures	Absence of or nonfunctioning 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 that reaches 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 Statewide Roads and Haul Routes

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 1405 FPAs in the 2014-15 sample. The resulting Roads prescription sample size was 13, and a total of 83 rules were evaluated.

Table 15. FP Rule Compliance for 2014-2015 Road Activities

Statewide Road Activities for 2014 & 2015		
All Landowner Types	**Status of Compliance**	**Road Activities Rule Compliance**
	# of Rules Sampled	83
	# Compliant Rules	81.7
	# with Deviation	1.3
	Compliance %	98.4%
	95% Confidence Interval	CI (95, 100)

Sample size = 13

Eighty-one point seven of the sampled 83 rules were compliant for the Roads prescription sample, resulting in a 98.4% compliance rate +/- 3%. Of the 13 sites sampled, 11 were 100% compliant and 2 showed deviation from at least 1 FP rule in the prescription type.

Field observations from 2014 and 2015 accounted for 2 non-compliance determinations across 2 sites. At 1 of the noncompliant sites, water was observed running across the road surface due to an inadequately sized ditch, resulting in a deviation. The other noncompliant observation was the result of a drainage structure not installed at the natural grade of the stream. Both noncompliant rules had a rating of Low Deviation. (Table 15.)

Haul Routes Findings

The Haul Route prescription 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 5 miles long. If the entire road was over 5 miles, ten 0.5-mile-long road segments were observed. Within each 0.5 mile, every 0.1-mile segment was observed as to its actual or potential delivery of sediment to typed water; and the primary and secondary causes for the delivery (see Table17) 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 slopes less than or greater than 60%. The data for side-slope percentage 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.*)

Table 16. Haul Route Compliance Summary

Compliant		Deviation		
90% (82, 98) CI*		9.6% (1.5, 18) CI		
No Delivery	**De Minimis**	**Low**	**Medium**	**High**
86% (76, 95) CI	4.7% (0, 11) CI	3.9% (0, 10) CI	5.6% (0, 24) CI	0.1% (0, 2.4) CI

*CI is confidence interval at the 95% confidence level

Table 17. Haul Route Deviation by Cause

Primary Cause	% Deviation with This Primary Cause
Inadequate water crossing structures	10%
Contaminated ditchwater	3%
Other (described in comments)	17%
Faulty cross drainage	14%
Stream of Spring Intercepted	5%
Road fill failure	2%
Sediment from stream adjacent parallel road	44%
Obstructed or bermed ditch line	2%
Water channeled to eroding slopes	2%

For 61.5 miles of the 67.4 miles of haul routes evaluated, no delivery or de minimus sediment delivery was observed, resulting in a compliance rate of 90% (Table 16). Sediment from stream adjacent parallel roads accounted for 44% of the deviation mileage (Table 17). The 17% that aggregates the “other” category is comprised of non-point-source sediment delivery and blocked drainage structures (Table 17). Faulty cross drainage accounted for 14% of the deviation mileage, and inadequate water crossing structures accounted for 10%, of the deviation mileage. All other primary cause categories accounted for less than 0.3 miles of deviation each respectively. For efficiency reasons, haul routes were observed on FPAs that had been selected for the harvest prescription sample.

7. Forest Practices Rule Trend Analysis

FPA rule compliance has been monitored since 2006. In that time, there have been multiple changes to the methods for monitoring compliance. The current monitoring methods include tracking compliance with individual rules, while sampling the rule applications in clusters (FPAs). One of the goals of the current analytical methodology is to detect trends in prescription, and individual rule compliance over time. The Compliance Monitoring Program feels this goal is best achieved by converting data collected prior to 2014 to be consistent with current data collection, and analytical protocols.

The sample size for each year is set based on maintaining a set precision level (+/- 6%) for average compliance within a set of rules (a prescription) over a two-year period. Because the population of FPAs available in any given year is finite and varying, the number of samples necessary to achieve a specific precision level also varies by year. Differing priorities and compliance estimation methods have caused differences in precision levels attainable by the samples collected in different years. In addition, methods for determining compliance with some individual rules has changed since 2006. These differences create challenges in determining and evaluating trends through time. However, with careful consideration, the difficulties are not insurmountable. On that basis, this report includes an analysis aimed at seeking to discern patterns of changes in compliance rates measured over time.

Methods

For the 2010-2015 dataset, rule compliance was carefully tracked to make sure that the compliance determination was consistently applied in all years. Data were converted to ensure consistent application of compliance determinations across the dataset. Where data were not collected in accordance with current field protocols, were incomplete, or un-convertible, the data were removed from the trend analysis dataset. Data for rules were combined and compared through time within each corresponding prescription type. Trends in average compliance with prescriptions, and individual rule compliance are tracked to maintain consistency with current methods.

Multivariate linear regression analysis was used to predict general trends in average compliance through time. However, because of the varying precision levels among years, the regression assumption of homogeneous variance in average compliance was not satisfied. In general, higher sample sizes as a proportion of the population result in lower variance. Because average compliance is a ratio, the standard error of the average is a function of the proportion of the population sampled in each year and the number of rules within the prescription applied on each FPA. Weighted least squares multivariate linear regression, where the average compliance is weighted by the inverse of the estimated mean standard error for each year, was employed, to correct for the nonhomogeneous variance. In this way, years with better estimates of average compliance receive more weight in the regression, which compensates statistically for unequal variance. Statistical significance was determined with $\alpha = 0.10$. The results for weighted linear regression are supplied. Residuals from regressions are tested for approximate normality using Shapiro-Wilks test with alpha = 0.05. P-values for significance of regressions were calculated, as well as 95% confidence intervals for linear regression coefficients for the weighted regression.

Although there is weak and varying precision within any given year for compliance with a single rule, it can still be useful to track changes through time for the FP rules. Statistical tests are not applied, but graphical trends are displayed for each prescription type.

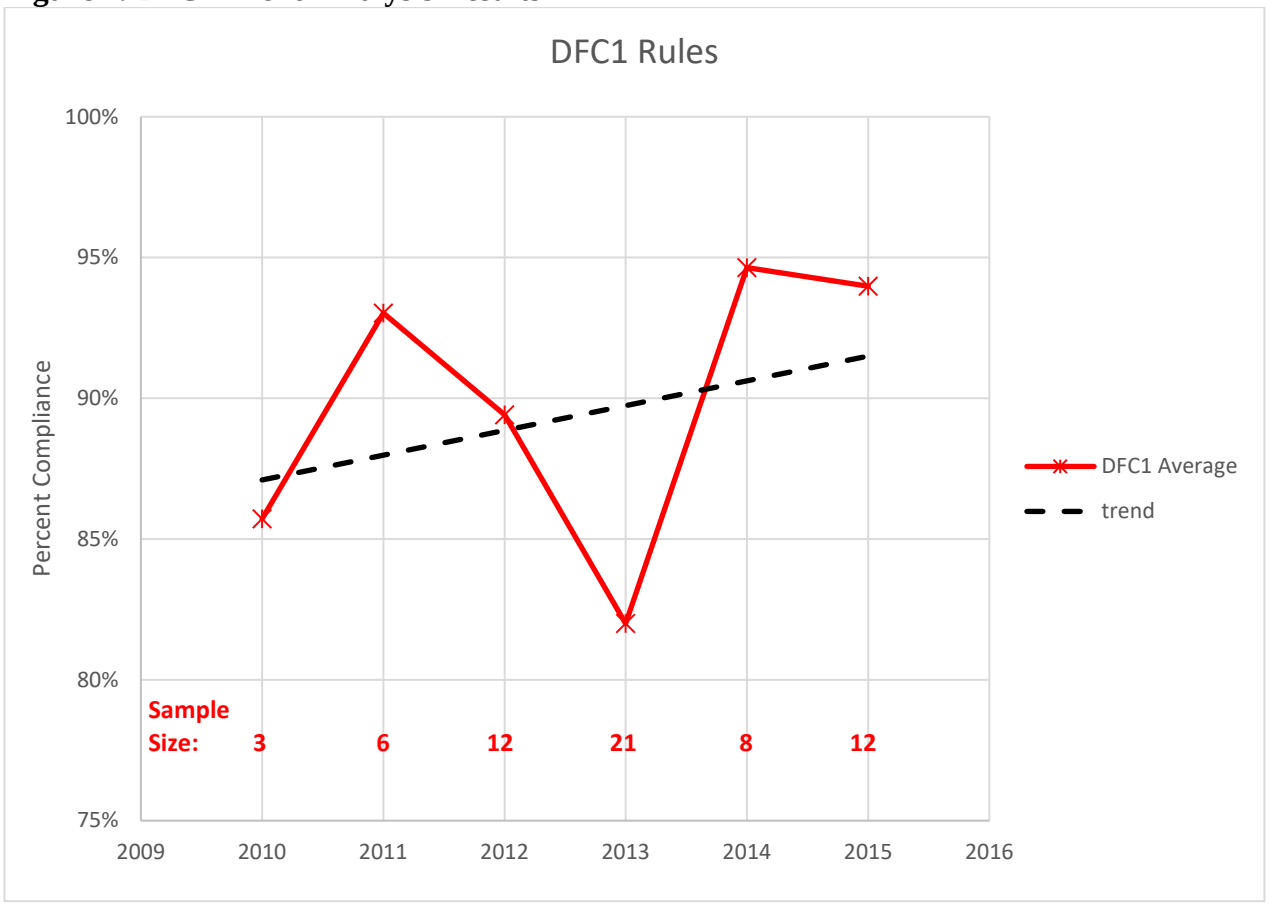
Since no individual rules are measured or tracked for Haul Routes trend analysis was not conducted for the Haul Route prescription type.

Results

Desired Future Condition 1

Trend analysis results for the DFC1 prescription type revealed varying compliance rates for the prescription, and the individual rules from year to year. Prescription compliance rates varied from 82% to 94% over the course of the evaluation period. As a result of the oscillating prescription compliance rate no significant trend results (weighted $p = 0.61$) were observed for the weighted DFC1 prescription type. (Figure 4.)

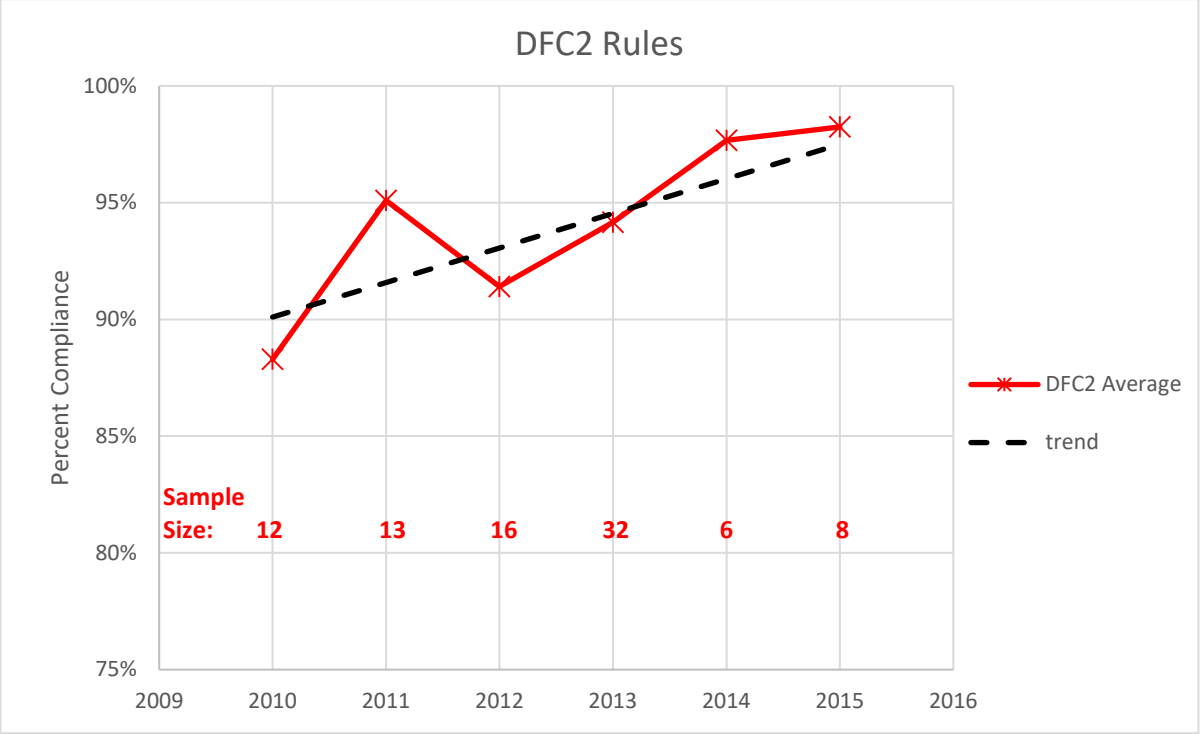
Figure 4. DFC1 Trend Analysis Results



Desired Future Condition 2

Trend analysis results for the DFC2 prescription type revealed varying compliance rates for the prescription, and the associated FP rules from year to year. Prescription compliance rates varied from 88% to 98% over the course of the evaluation period. As a result of the oscillating prescription compliance rate, no significant trend results for weighted regression analysis (p = 0.11) were observed for the weighted DFC2 prescription. (Figure 5.)

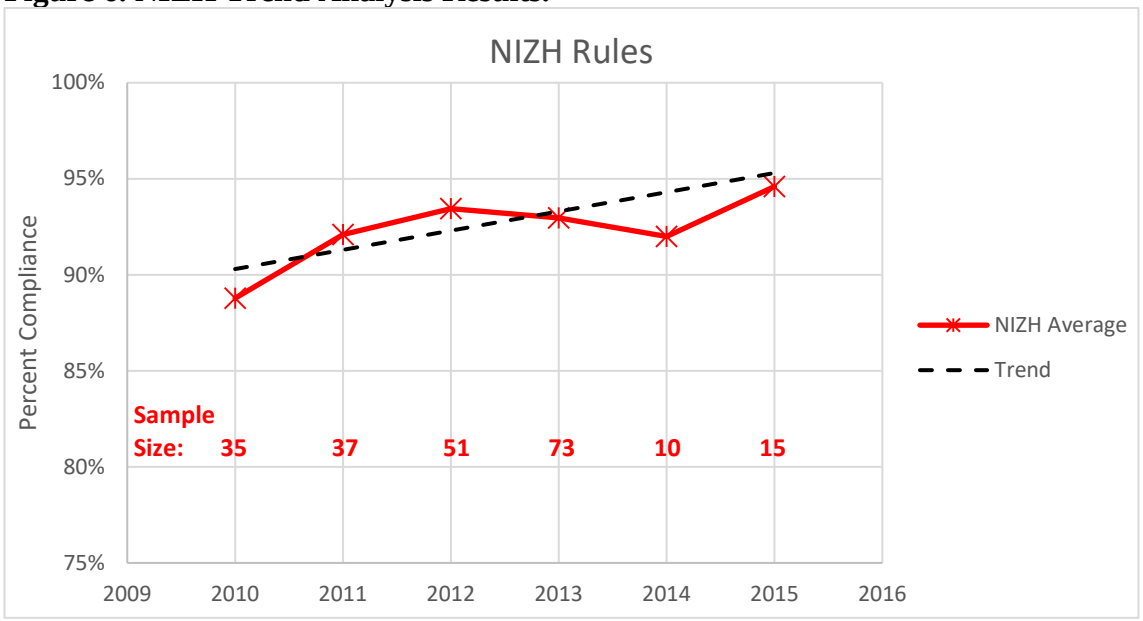
Figure 5. DFC2 Trend Analysis Results



No Inner Zone Harvest

Trend analysis results for the NIZH prescription type revealed relatively consistently increasing compliance rates for the prescription, and the associated FP rules from year to year. Prescription compliance rates varied from 89% to 94% over the course of the evaluation period. As a result of the increasing prescription compliance rate, significant trend results (weighted $p = 0.07$) were observed for the weighted NIZH prescription. A year over year increase of 1.0% of the overall prescription compliance rate was observed. (Figure 6.)

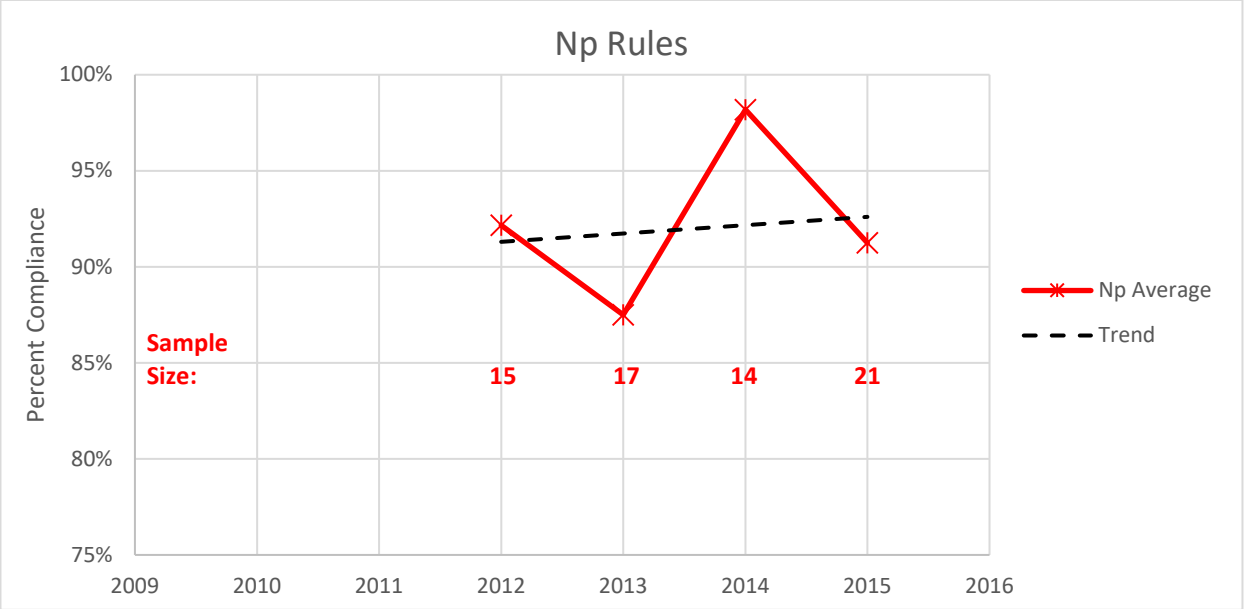
Figure 6. NIZH Trend Analysis Results.



Non-fish Bearing Perennial Streams

As a result of data transformation issues, Np data collected from 2010 and 2011 were excluded from current trend analysis results. Trend analysis results for the Np prescription type revealed varying compliance rates for the prescription, and the associated FP rules from year to year. Prescription compliance rates varied from 88% to 98% over the course of the evaluation period. As a result of the oscillating prescription compliance rate no significant trend results (weighted $p = 0.77$) were observed for the weighted Np prescription type. (Figure 7.)

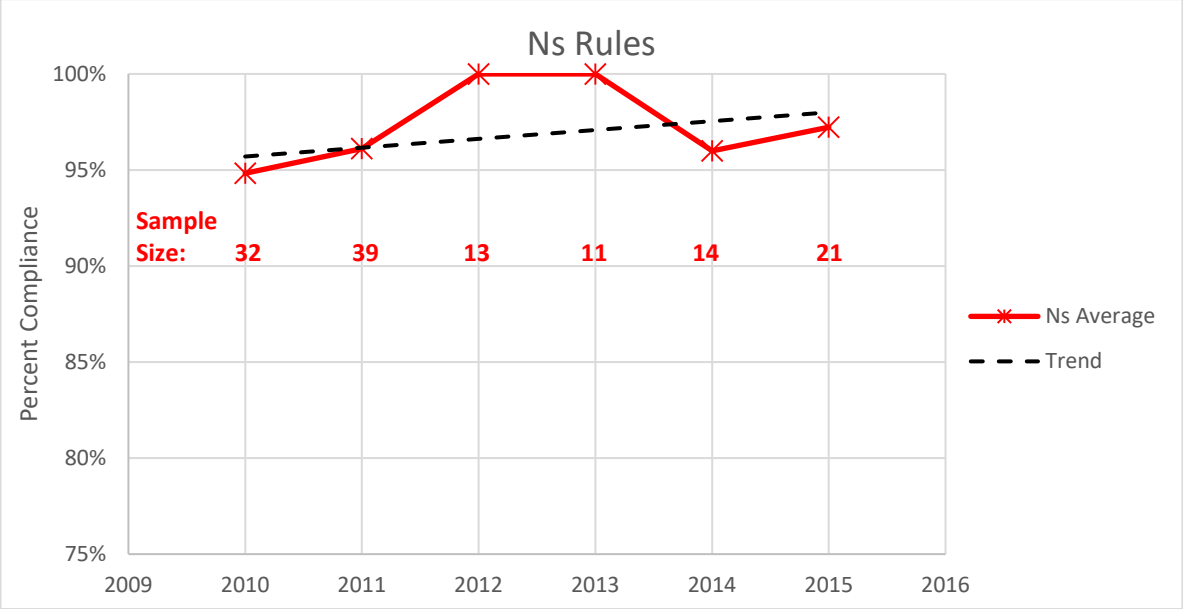
Figure 7. Np Trend Analysis Results



Non-fish Bearing Seasonal Streams

Trend analysis results for the Ns prescription type revealed increasing compliance rates for the prescription, and the associated FP rules from 2010 to 2012 and a decrease in compliance rates from 2013 to 2015. Prescription compliance rates varied from 95% to 100% over the course of the evaluation period. As a result of the oscillating prescription compliance rate no significant trend results (weighted $p = 0.30$) were observed for the weighted Ns prescription type. (Figure 8.)

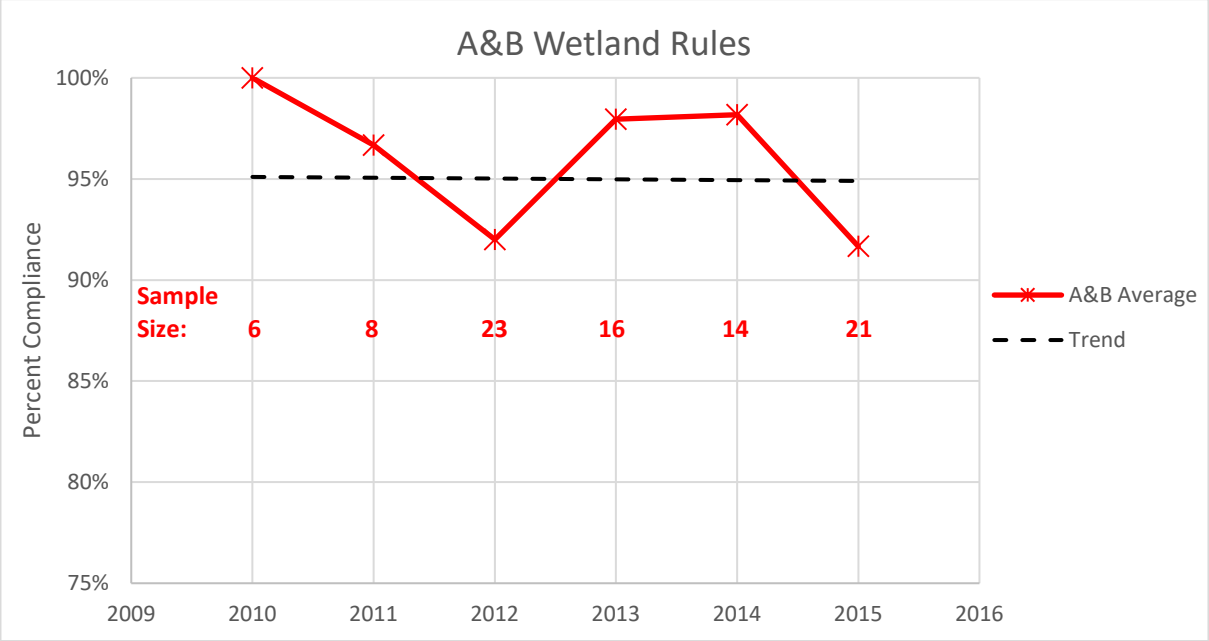
Figure 8. Ns Trend Analysis Results



A & B Wetlands

Trend analysis results for the A & B Wetlands prescription type revealed varying compliance rates for the prescription, and the associated FP rules from year to year. Prescription compliance rates varied from 92% to 100% over the course of the evaluation period. As a result of the oscillating prescription compliance rate no significant trend results (weighted $p = 0.97$) were detected for the weighted A & B Wetlands prescription type. A flat trend line for prescription compliance was observed. (Figure 9.)

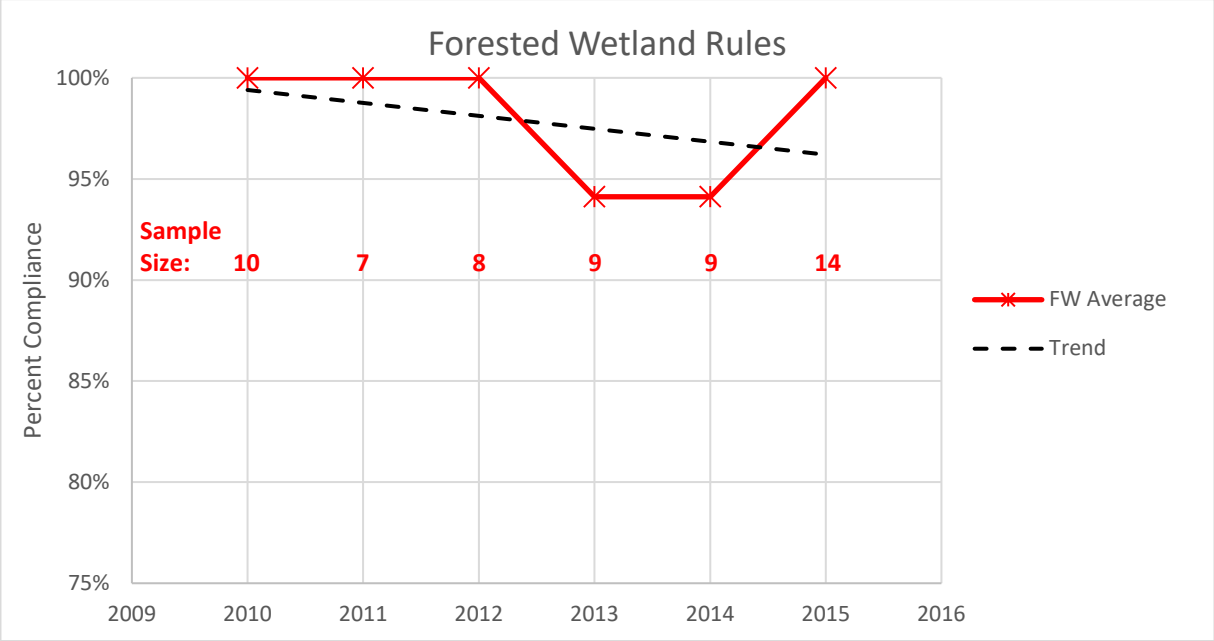
Figure 9. A & B Wetlands Trend Analysis Results



Forested Wetlands

Trend analysis results for the Forested Wetlands prescription type revealed 100% compliance rates for the prescription, and the associated FP rules from 2010 to 2012, and varying compliance rates from 2013 to 2015. Prescription compliance rates varied from 94% to 100% over the course of the evaluation period. As a result of the oscillating prescription compliance rate no significant trend results (weighted $p = 0.41$) were observed for the weighted Forested Wetlands prescription type. (Figure 10.)

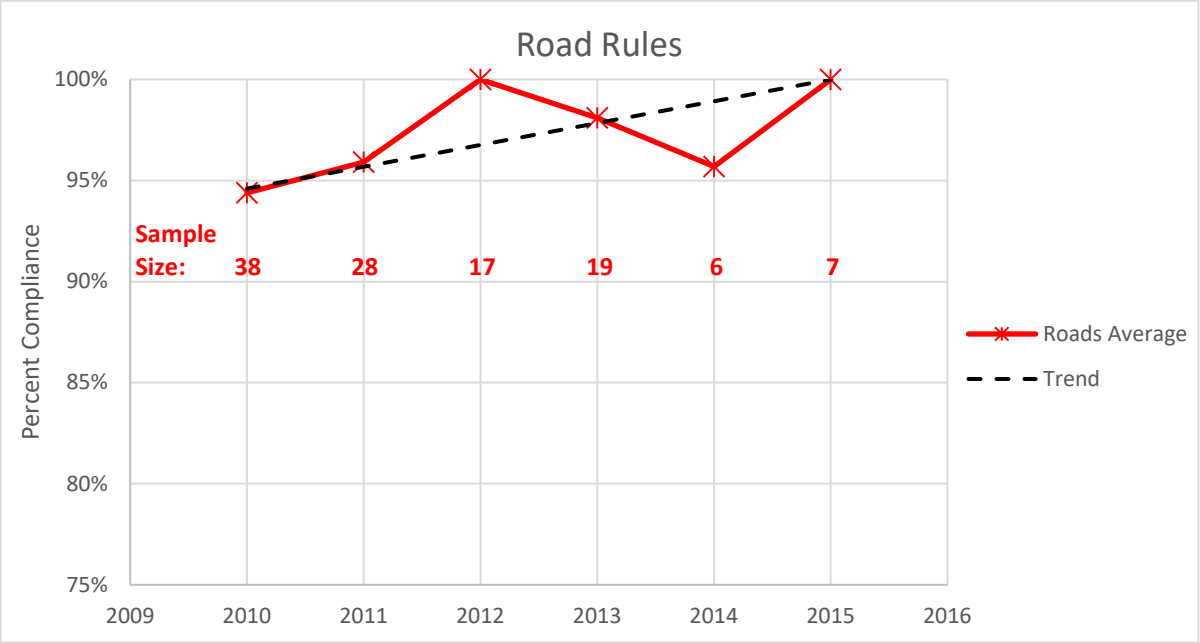
Figure 10. Forested Wetlands Trend Analysis Results



Roads

Due to the large number of individual rules that comprise the Roads prescription (42), only prescription compliance is visually represented in the report. Trend analysis results for the Roads prescription type revealed a possible increasing trend in prescription compliance, and varying compliance for individual rules from year to year. Prescription compliance rates varied from 94% to 100% over the course of the evaluation period. As a result of the relatively increasing prescription compliance rates, significant trend results for weighted regression analysis (p = 0.035) depicting a year over year increase of 1.4% of the overall prescription compliance rate were observed for the Roads prescription type. (Figure 11.)

Figure 11. Roads Trend Analysis Results



Additional results that depict the relationship between individual rules and the prescription types they comprise can be found in Appendix C.

8. Forest Practices Application Compliance

Section 8 addresses compliance with the forest practices application (FPA).

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, per professional opinion the deviation is a result of the timber harvest design layout and/or approval process. When the FPA is compliant with FP rules but deviates from the landowner's stated protections on the FPA, typically what the landowner proposed, and committed to, conduct activities that were more conservative than what was implemented. (Table 18.)

Table 18. 2014-15 Compliance with FPAs for Riparian and Wetland Harvest Prescriptions

		Western WA		Statewide					
	Status of Compliance	DFC1	DFC2	No Inner Zone Harvest	Np Activities	Ns Activities	Type A&B Wetlands	Forested Wetlands	Roads
Small Forest Landowners	# Compliant Rules	4	0	9	1	4	33	4	n/a
	# with Deviation	1	0	1	0	0	1	0	n/a
	% of Sample Compliant	80%	n/a	91%	100%	100%	97%	100%	n/a
	Confidence Interval	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Prescriptions Assessed	1	0	4	1	4	9	4	0
Large Forest Landowners	# Compliant Rules	68	56	61	99	25	73	13	70
	# with Deviation	6	2	4	8	0	5	0	1.3
	% of Sample Compliant	92%	97%	94%	93%	100%	94%	100%	98%
	Confidence Interval	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Prescriptions Assessed	19	14	21	34	25	27	12	12
All Landowners	# Compliant Rules	72	56	71	100	29	106	17	69.7
	# with Deviation	7	2	5	8	0	6	0	1.3
	% of Sample Compliant	91%	97%	93%	93%	100%	95%	100%	98%
	Confidence Interval	(88, 94)	(92, 100)	(88, 99)	(87, 99)	n/a	(88, 100)	n/a	(95, 100)
	Prescriptions Assessed	20	14	25	35	29	36	16	12

Table 19. 2014-2015 Comparison between FPA and Rule Compliance Assessments by Count

	RMZ Prescription	Total Prescriptions Sampled	FPA and Rule Compliance the Same	Deviation from FPA and Rule Compliant	FPA Compliant and Deviation from Rule	Deviation from Rule and FPA Indeterminate	FPA Compliant / Rule Indeterminate
Statewide	RMZ — No Inner Zone Harvest	25	123	1	1	0	0
	RMZ — Type Np Prescriptions	35	34	0	1	0	0
	RMZ — Type Ns Prescriptions	35	34	0	0	1	0
	WMZ — Type A&B Wetlands	35	31	2	3	0	0
	WMZ — Forested Wetlands	23	22	0	1	0	0
	Roads	13	13	0	0	0	0
Western WA	RMZ — Type S or F Inner Zone Harvest DFC1	20	19	0	1	0	0
	RMZ — Type S or F Inner Zone Harvest DFC2	14	14	0	0	0	0

Findings for FPA/FP Rule Compliance Differences

There are few differences between FPA compliance and FP rule compliance for the 2014-2015 sample. Differences were found in the statewide NIZH, DFC1, Type Np, Ns, Type A&B Wetlands, and Forested Wetlands prescription samples. (Table 19.)

2014 and 2015 field observations resulted in the following differences between FPA compliance and FP rule compliance:

Within the DFC option 1 prescription, the difference occurred as a deviation from FPA compliant/ Rule non-compliant, where, the landowner incorrectly measured the RMZ length resulting in the harvest within the Inner Zone not meeting the requirements of the Inner Zone leave tree strategy by diameter class. Using the correct RMZ length in the DFC software program revealed that Inner Zone harvest is not supported at the site, and no DFC harvest option would have been allowed.

Within the NIZH prescription, 2 samples deviated from either rule or application compliance. For the first sample, the landowner incorrectly identified site class on their FPA resulting in harvest occurring within the Inner Zone. The landowner met the requirements based on the site class identified on their FPA. However, the compliance monitoring field team determined that the site class was incorrect resulting in an insufficient Inner Zone buffer. The sample was compliant with the FPA, and non-compliant with the rule. For the second sample, as a result of an incorrectly identified site class on their FPA the landowner left a no-cut Inner Zone buffer larger than required. The landowner indicated that the harvest area was within site class 2, however, the compliance monitoring field team determined that site class 5 was correct for the area in question. Resulting in wider buffers than required. The sample was compliant with the rules, and non-compliant with the FPA.

Within the Np prescription, the difference occurred as a deviation from the Rule/FPA Compliant, where the landowner treated the stream as an Np but it was determined to be an F by the CMP field staff. Neither a Water Type Modification Form nor related Interdisciplinary Team documentation was received by region FP staff. During the compliance monitoring field visit, the stream met the criteria of a Type F stream (> 2’ wide and < 16% gradient). The sample was determined to be compliant with the wording on the FPA, and non-compliant with the rule.

Within the statewide Type Ns prescription, the difference occurred as a deviation from the Rule/FPA Indeterminate, where the landowner treated the stream as an Ns but it was determined to be an Np by the CMP field review. The landowner used ambiguous “typing” related language on the FPA. The FPA indicated that if no flowing water was observed in the channel, the stream would be typed Ns for harvest related operations. Neither a Water Type Modification Form nor related Interdisciplinary Team documentation was received by region FP staff. During the compliance monitoring field visit, flowing water was observed in the channel, resulting in the determination of Type Np water. The field visit occurred in September, near to the time of seasonally low water flows. The sample was concluded to be a deviation from FP rules; however, due to the ambiguous language on the FPA, application compliance was rated Indeterminate.

Within the Type A&B Wetlands prescription, 5 samples deviated from either rule or application compliance. For the first sample, the landowner declared on the FPA that a 50-foot no-cut buffer would be utilized around a Type B wetland, when only a 25-foot no-cut buffer was required by FP rules. During the compliance monitoring site visit, it was observed that the landowner met the 25-foot requirement but harvested within 50 feet of the wetland. The sample was compliant with FP rules but not compliant with the language on the FPA. For the second sample, the landowner declared that the

selected wetland was Type A. However, during the compliance monitoring field review, it was determined that the wetland was an associated wetland of a fish-bearing water. This determination resulted in the sample being compliant with the FPA but non-compliant with the FP rules. For the third sample, the difference occurred as a deviation from the Rule/FPA Compliant, where the landowner treated the water as an A wetland, but it was determined to be an F water by the CMP field staff. A stream flowing into the wetland met the criteria for Type F per was observed by the compliance monitoring field team. The wetland was determined to be associated with the F stream. Neither a Water Type Modification Form nor related Interdisciplinary Team documentation was received by region FP staff. The sample was determined to be compliant with the wording on the FPA, and non-compliant with the rule. For the fourth sample, the difference occurred as a deviation from the rule/FPA Compliant, where the landowner treated the water as an A wetland, but it was determined to be an F water by the CMP. A stream flowing through the wetland was typed as an F stream on the DNR hydro layer. The wetland was determined to be associated with the F stream. Neither a Water Type Modification Form nor related Interdisciplinary Team documentation was received by region FP staff. The sample was determined to be compliant with the wording on the FPA, and non-compliant with the rule. For the fifth sample, the variable buffer width was not appropriate relative to the WMZ. The landowner left a buffer that was wider than required. The sample was compliant with the rules, and non-compliant with the FPA.

9. Report Discussion

Riparian and Wetland Compliance Proportioned across the Population

Tables that describe 2014-2015 riparian and wetland findings are located in Sections 5.2, 5.3, and 5.4 for individual prescription types. Section 5 also provides estimates of the population sizes for each prescription type. Table 20 (below) summarizes FP rule compliance according to these estimated populations. The sampling methodology employed provides desired precision for a biennial sample but does not support an unbiased approach 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.

Table 20. 2014-15 Estimated Population Size and Associated FP Rule Compliance

Prescription Type	Estimated Population of FPAs with the Prescription	Compliance Percentage
RMZ — Type Np Prescriptions	929	94%
RMZ — Type Ns Prescriptions	1018	97%
RMZ — Type S or F No Inner Zone Harvest	737	94%
Forested Wetlands	322	97%
Type A&B Wetlands	237	95%
Western WA RMZ — Type S or F Inner Zone Harvest DFC2	157	98%
Western WA RMZ — Type S or F Inner Zone Harvest DFC1	55	94%
Roads	1405	98%
Haul Routes	NA*	90%

*The Haul Routes prescription does not have an estimated population.

Compliance Monitoring Program Challenges

Representation of Complete Compliance

In most scenarios where there is deviation from at least one FP rule within a specific prescription there is compliance with the remaining FP rules in that prescription. In fact, it is not unusual for prescriptions rated a minor deviation to also exceed rule requirements for some other FP rules in that prescription. For example, with DFCs, if there were too few outer zone trees, there were often also excess trees in the inner zone, where trees have greater riparian benefits to streams. In this example, although letter of the rule was not met, more trees remained within the RMZ than the minimum required by rule.

The expectation is for landowners to follow all FP rules. However, there is more to evaluating compliance with 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 the results.

Sample and Measurement Error

The CMP resolves the inability to determine statistical variability for average values by assigning a standard absolute 5% measurement error tolerance. This measurement error tolerance applies for only 3 specific measurements: when determining 1) stream bankfull width; 2) leave tree to edge of bankfull width; and 3) buffer widths and lengths or floors within RMZs. When a landowner's buffer is within 5% of the compliance monitoring field team's measured buffer, the values are considered the same. If the landowner's buffer value falls outside the 5% error tolerance, the compliance monitoring field team's measured buffer is assumed to be correct and the landowner's buffer incorrect.

Variation in Natural Conditions

Because natural features are variable, on-site conditions sometimes 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 and ultimately eliminate indeterminate determinations. This may involve revisiting rule interpretation and how to apply the rules in imprecise situations or developing suggested changes to make clarification in FP rules and/or board manual guidance.

Shade

Shade is a key function provided by the RMZ and as such is of interest to the CMP for monitoring. However, compliance monitoring of riparian shade rules has presented challenges that have precluded the ability to monitor for shade compliance.

Checking shade documentation for compliance and taking measurements in the field to determine if the required amount of vegetation was left to meet temperature standards both continue to be issues. Measurement repeatability is of concern when using a densiometer (the instrument used to determine shade). Also, when the compliance monitoring field team conducts an on-site review, the trees have been harvested, so it is impossible to re-create original conditions. Currently, the CMP does not take shade measurements in the field.

10. Forest Practices Program/Forest Practices Rule Changes Based on Compliance Monitoring Feedback

Several rule and Board Manual updates are currently in process as a result of the 2012–2013 CMP biennium report. Leave tree, DFC, and RMZ length rule and Board Manual clarifications are currently under review and have been scheduled in the 2017 Forest Practices Board work plan. Rule and Board Manual clarifications were presented at the May 2015 and 2016 Forest Practices Board meeting.

11. Glossary

bankfull width (BFW).

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, bank full width is the sum of the individual channel widths along the cross section (see Board Manual, Section 2).
b) **For lakes, ponds, and impoundments** — the line of mean high water.
c) **For tidal water** — the line of mean high tide.
d) **For periodically inundated areas of associated wetlands** — The line of periodic inundation, found by examining the edge of inundation to ascertain where the presence and action of waters are so common and usual, and of so long a duration 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 4.5 feet above the ground.

Bull Trout Habitat Overlay. Those portions of Eastern Washington streams containing bull trout habitat as identified by the Department of Fish and Wildlife's bull trout map.

Channel migration zone (CMZ). The area within which the active channel of a stream is prone to move, resulting 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.)

Clear-cut. A harvest method in which the entire stand of trees is removed in 1 timber harvesting operation (except for trees required by rule or law to be left uncut).

Confidence interval. A type of interval estimate of a population parameter, 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. The percentage of canopy overlying the forest floor.

Desired future condition (DFC). 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." The DFC is a reference point on a pathway and not an endpoint for forest stands.

Diameter breast height (DBH). The diameter of a tree at 4.5 feet above the ground measured from the uphill side.

Dominant and co-dominant trees.

a) **Dominant** — Trees or shrubs with crowns receiving full light from above and partly from the side. Typically larger than the average trees or shrubs in the stand, with crowns that extend above the general level of the canopy and are well developed but possibly somewhat crowded on the sides.

b) **Co-dominant** — a tree that extends its crown into the canopy and receives direct sunlight from above and 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 (ELZ). A 30-foot-wide zone measured horizontally from the outer edge of the bankfull width of Type Np or Ns waters. ELZ rules apply to all perennial and seasonal non-fish-bearing streams.

End hauling. 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.

Finite population correction factor. A formula frequently used in statistics and probability that allows adjustment to a population from larger to smaller or to indicate no change in the population. The result of the formula's calculation is called the "z-factor."

Forest practices application or notification (FPA or FPN). The DNR form used by forest landowners to apply for approval of a class III or IV forest practice or to notify DNR that they are conducting a class II forest practice.

a) **FPA** — an application for a permit to conduct a site class III or IV forest practice. Site class III and IV forest practices have a higher potential to impact a public resource than does a site class II forest practice.
b) **FPN** — a notification to DNR that a class II forest practice will take place. Class II forest practices have less than ordinary potential to damage a public resource.

Forest road. Since 1974, lanes, roads, or driveways on forestland used 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 forestland.

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

Laser hypsometer. An instrument that measures the distance to the top and bottom of an object and that measures the angle between the lines from the observer to each top and bottom to calculate height of the object.

100-year flood level. A "100-year" event means a calculated flood event flow based on an engineering computation of flood magnitude that has a 1% chance of occurring in any given year.

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.

Prescription. A grouping of similar rules by forest practices activity type (e.g., No Inner Zone Harvest, Desired Future Condition Option 1, Desired Future Condition Option 2, Non-Fish-Bearing Perennial Stream, Non-Fish Bearing Seasonal Stream, Type A&B Wetlands, Forested Wetlands, Roads, and Haul Routes).

Public resources. Water, fish, and wildlife; also, 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 important to both riparian forest and aquatic system conditions.

Riparian management zone (RMZ). The area 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. Areas near or adjacent to Type Np water and that have one or more of the following:

a) **Headwall seep** — a seep located at the toe of a cliff or other steep topographical feature and at the head of Type Np water, connecting to the stream channel network via overland flow and characterized by loose substrate and/or fractured bedrock with perennial water at or near the surface throughout the year.
b) **side-slope seep** — a seep within 100 feet of Type Np water located on side slopes with grades greater than 20%, 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.
c) **Type Np intersection** — the intersection of 2 or more Type Np waters.
d) **Headwater spring** — 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.
E) **Alluvial fan** — a depositional landform consisting of a cone-shaped deposit of waterborne, often coarse-sized sediments.

Sidecast. The act of moving excavated material to the side and depositing such material within the limits of construction or dumping it over the downhill 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. Including a significance level prevents the investigator, as far as possible, from inadvertently making false claims.

Site class. A growth potential rating for trees within a given area based on 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:

50-year site index range (state soil survey)

Site class	Years
I	137+
II	119–136
III	97–118
IV	76–96

V < 75

Stand requirement. The number of trees per acre, the basal area, and the proportion of conifers in the combined core and inner zone such that the growth of the trees would meet the desired future condition.

Stream adjacent parallel roads. Roads (including associated right-of-way clearing) in an RMZ on a property that have an alignment 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 not subject to forest practices rules, or roads of another adjacent landowner.

Temporary road. A forest road constructed and intended for use during the life of an approved FPA or FPN.

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

Wetland management zone (WMZ). 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 wetland.

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

12. Appendix A: Statistical Methods

Methods for Calculation of Compliance and Confidence Intervals

Estimation of Compliance

The mean or average compliance and the variance of the mean are calculated according to the rules of estimation for cluster samples (See, for example, Cochran, 1963; Schaeffer et al., 1990). The mean compliance for a prescription is the ratio of the number of compliant rules divided by the total number of rules sampled across all FPAs in the prescription:

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

Where n is the number of FPAs sampled for the prescription, x_i is the number of rules applied on the ith FPA in the sample, and y_i is the number of rules that were complied with on the ith FPA.

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,

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

and N is the estimated population size for the prescription.

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

Ratio Proportions

Some compliance proportions 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 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. The denominator of the compliance ratio is a random variable because the length of road being evaluated differs among FPAs. 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% 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: 32).

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 to 100%.

13. Appendix B: 2014-2015 Biennium Individual Rule Compliance by Prescription

Table column headers may not reflect actual field form question wording

Desired Future Condition Option 1

DFC1 (n=20)	Overstory Tree Species match DFC worksheet (222-30-021(ii)(B)(I))	Site Class (222-16-010)	Stream Size (222-16-031(2)(3))	No harvest in Core Zone 222-30-021(a)	Inner Zone meets diameter leave tree strategy (222-30-021(ii)(B)(I))	Largest 57 TPA left in Inner Zone (222-03-021(ii)(B)(I)	Unstable slopes bounded out (222-16-050(d))	Correct # Outer Zone leave trees (222-30-021(iii)(c))
Compliance	19	20	20	17	17	19	0	19
Assessed	19	20	20	20	20	19	1	20
% compliant	100%	100%	100%	85%	85%	100%	0%	95%
95% CI	(85, 100)	(86, 100)	(86, 100)	(66, 95)	(66, 95)	(85, 100)	n/a	(79, 100)

Desired Future Condition Option 2

DFC2 (n=14)	Overstory Tree Species match DFC (222-30-021(ii)(B)(II))	Site Class (222-16-010)	Stream Size (222-16-031(2)(3))	No harvest in Core Zone (222-30-021(a))	No harvest in floor Zone (222-30-021(ii)(B)(II)	20 conifer TPA in outer portion of IZ (222-30-021(ii)(B)(II))	Unstable slopes bounded out (222-16-050(d))	Correct # Outer Zone leave trees (222-30-021(iii)(c))
Compliance	14	14	14	14	12	14	2	14
Assessed	14	14	14	14	14	14	2	14
% compliant	100%	100%	100%	100%	86%	100%	100%	100%
95% CI	(78, 100)	(78, 100)	(78, 100)	(78, 100)	(58, 98)	(78, 100)	(19, 100)	(78, 100)

No Inner Zone Harvest

NIZH (n=25)	Stream Size (222-16-031(2)(3))	Site Class (222-16-010)	No harvest in Core Zone (222-30-021(a))	No harvest in Inner Zone (222-30-021(b)	Correct # Outer Zone leave trees (222-30-021(iii)(c))	Unstable slopes bounded out (222-16-050(d))	Observed CMZ 0222-30-020(13)
Compliance	24	22	25	22	22	1	0
Assessed	24	24	25	25	23	1	2
% compliant	100%	92%	100%	88%	96%	100%	0%
95% CI	(86, 100)	(73, 99)	(86, 100)	(69, 97)	(78, 100)	n/a	n/a

Non-Fish Bearing Perennial Streams

Np (n=35)	Np stream size (222-16-031(4))	Is ≤ 10% of ELZ exposed (222-30-021(2)(a))	Appropriate Length of 50 foot buffer (222-30-021(2)(b)(vii))	No harvest within required 50 foot buffer (222-30-021(2)(b)(i))	No harvest 50 feet from headwall seeps & springs (222-30-021(2)(b)(ii)(iii))	56ft PIP & Confluence buffer (222-30-021(2)(b)(iv)(v))	Unstable slopes bounded out (222-16-050(d))	Salvage within the Np RMZ (222-30-045(5))
Compliance	32	15	26	26	3	19	4	3
Assessed	35	15	27	28	3	21	4	3
% compliant	91%	100%	96%	93%	100%	90%	100%	100%
95% CI	(77, 98)	(79, 100)	(81, 100)	(77, 99)	(30, 100)	(70, 99)	(41, 100)	(30, 100)

Non-Fish Bearing Seasonal Streams

Ns (n=35)	Ns stream size (222-16-031(5))	Is ≤ 10% of ELZ exposed (222-30-021(2)(a))
Compliance	33	26
Assessed	35	26
% compliant	94%	100%
95% CI	(81, 99)	(87, 100)

A & B Wetlands

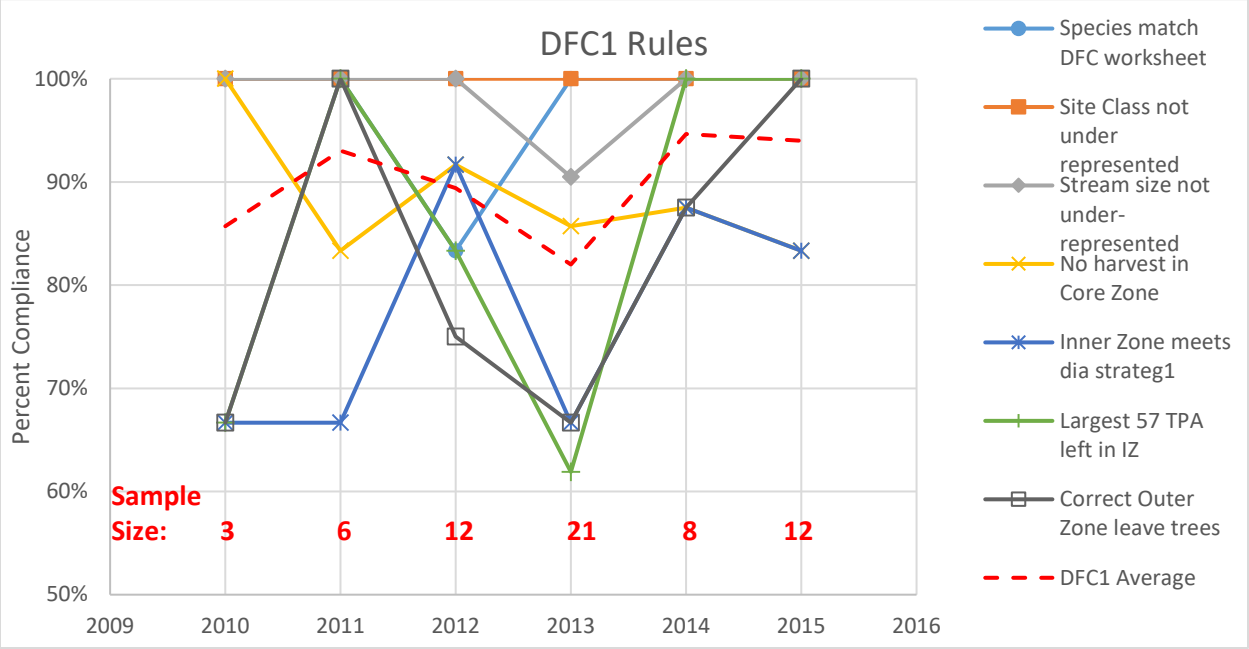
A&B Wetlands (n=35)	Wetlands type & size (222-16-035(1)(a) &(b))	Variable buffer width appropriate (222-30-020(8)(a))	Openings less than 100' wide (222-30-020(8)(d)	Leave trees species represent pre-harvest (222-30-020(6))	Ground based in min WMZ had approval (222-30-020(8)(e))	WMZ-RMZ overlap-best protection used (222-30-020(8)	50 TPA GT 6in WW (4in EW) (222-30-020(8)(b))	20 TPA GT12in,where they exist (222-30-020(8)(b))	5 TPA GT20in, where they exist (222-30-020(8)(b))
Compliance	28	22	1	24	3	3	14	14	11
Assessed	32	22	1	24	3	3	15	15	12
% compliant	88%	100%	100%	100%	100%	100%	93%	93%	92%
95% CI	(72, 96)	(86, 100)	(6, 100)	(87, 100)	(33, 100)	(33, 100)	(70, 100)	(70, 100)	(64, 100)

Forested Wetlands

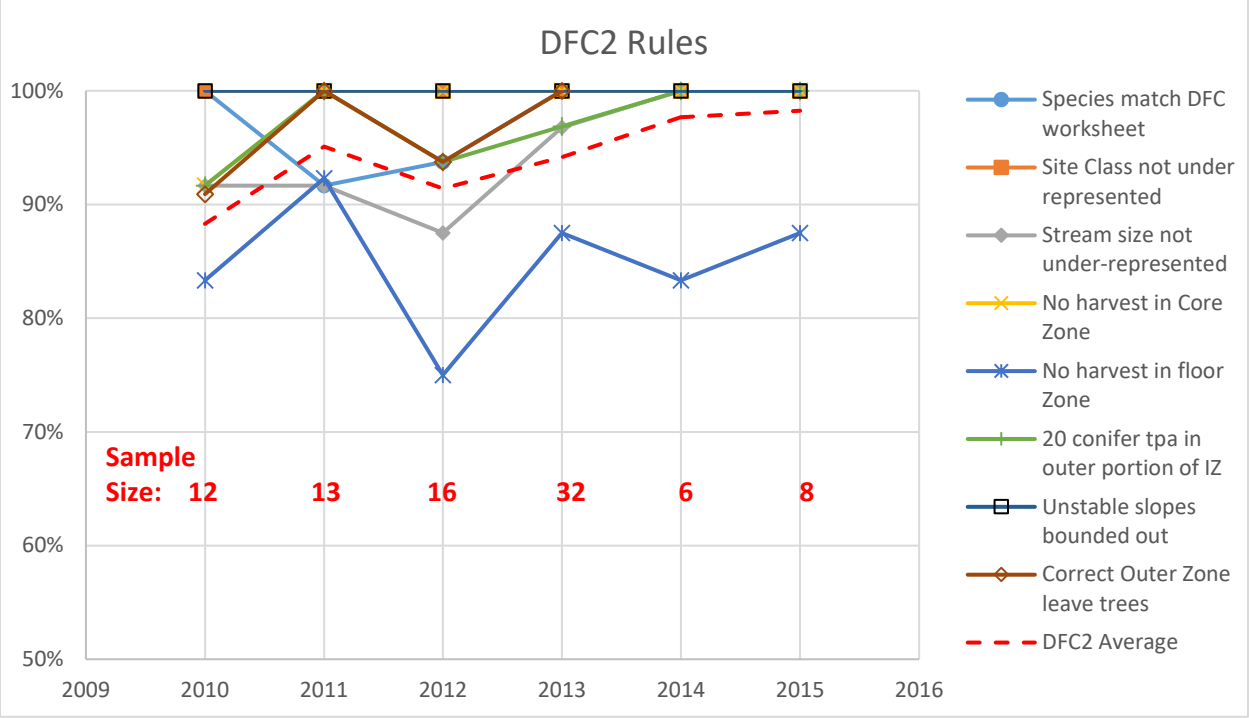
Forested Wetlands (n=23)	Wetlands type & size consistent (222-06-035(2))	If harvest occurred, low impact used (222-30-020(7))	If greater than 3 acres, was it mapped (222-16-036(3))
Compliance	22	11	5
Assessed	23	11	5
% compliant	96%	100%	100%
95% CI	(79, 100)	(72, 100)	(49, 100)

14. Appendix C: Trends of Individual Rules

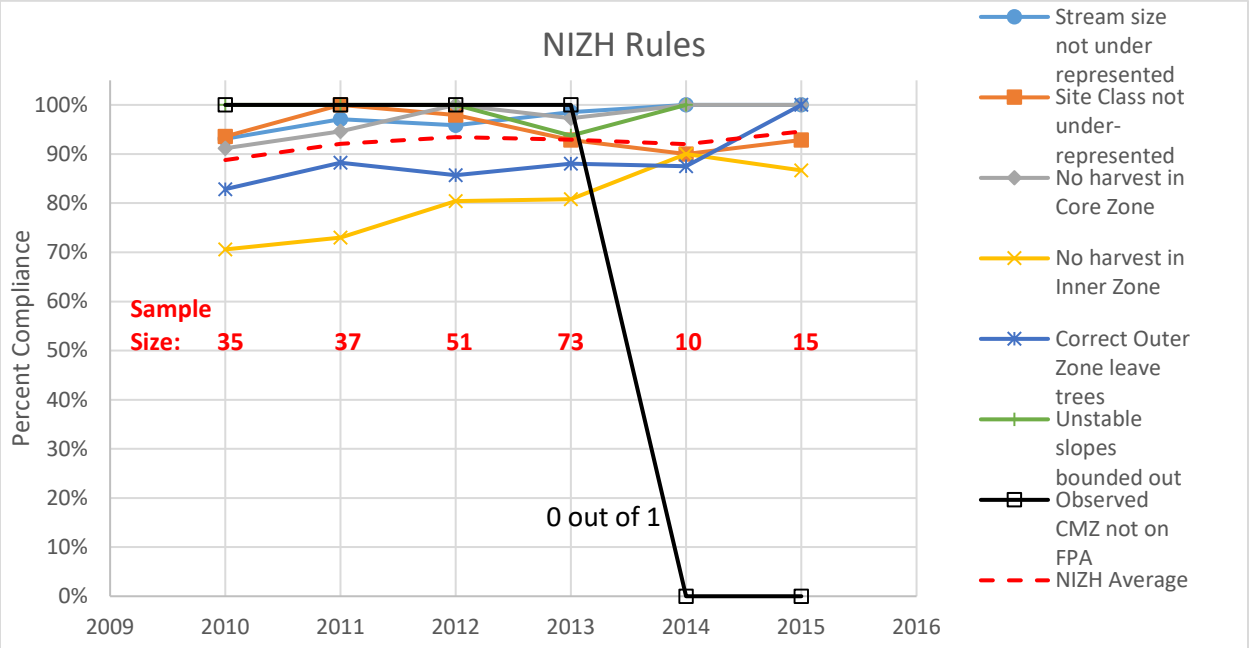
Desired Future Condition 1



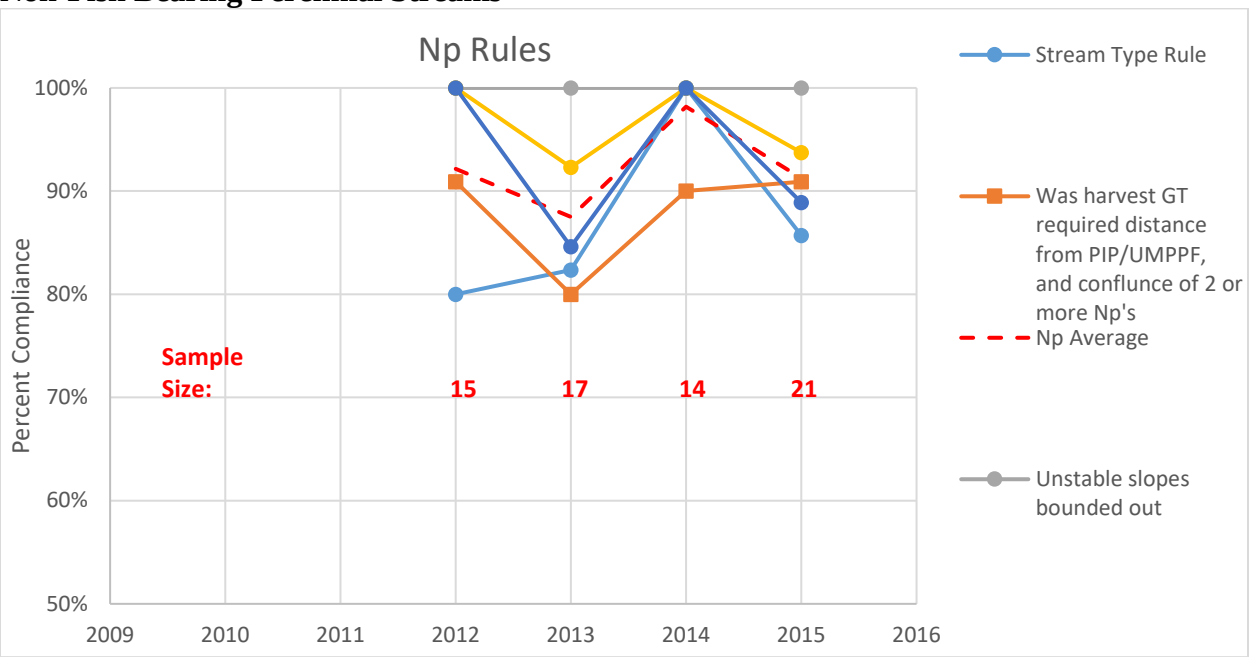
Desired Future Condition 2



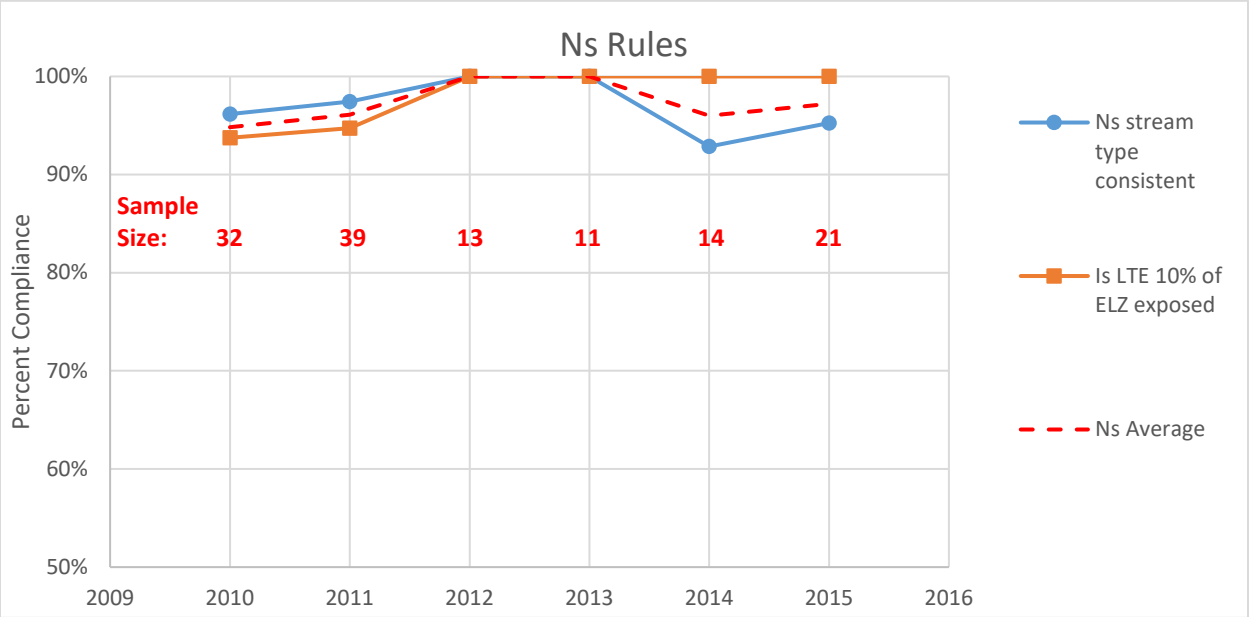
No Inner Zone Harvest



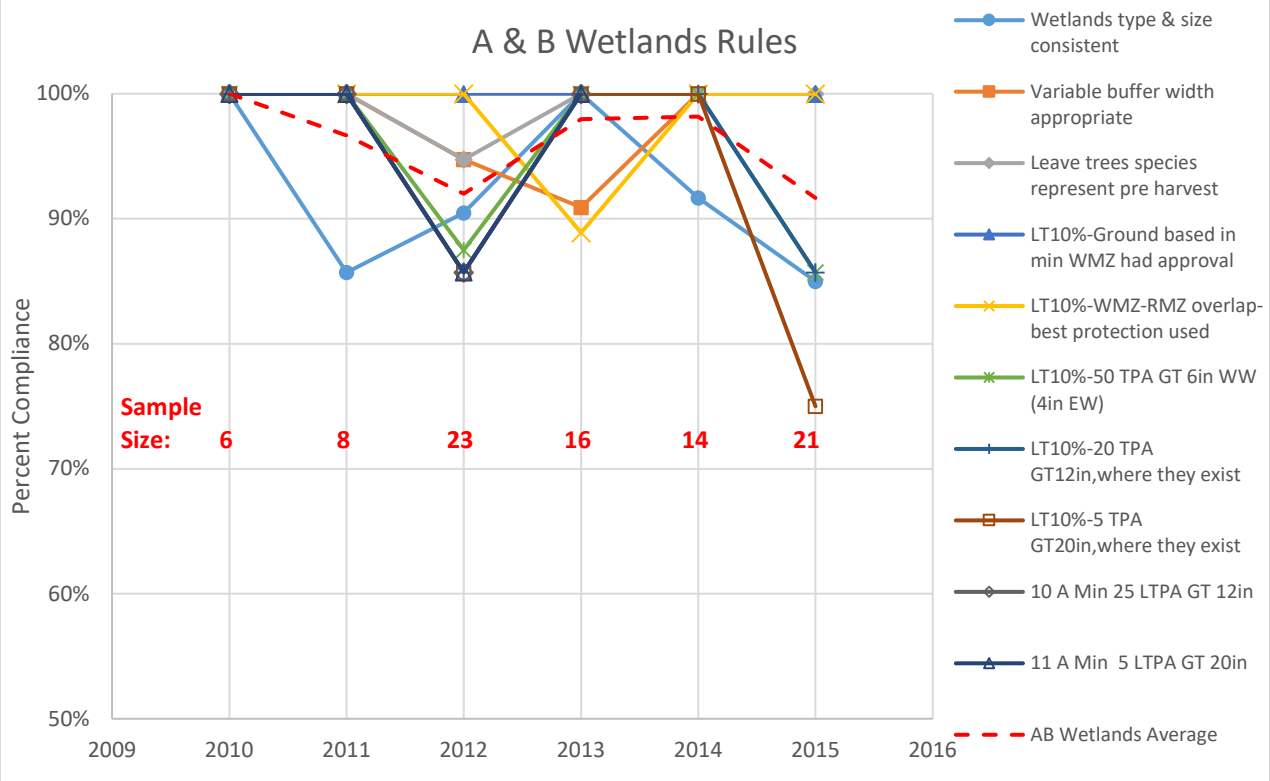
Non-Fish Bearing Perennial Streams



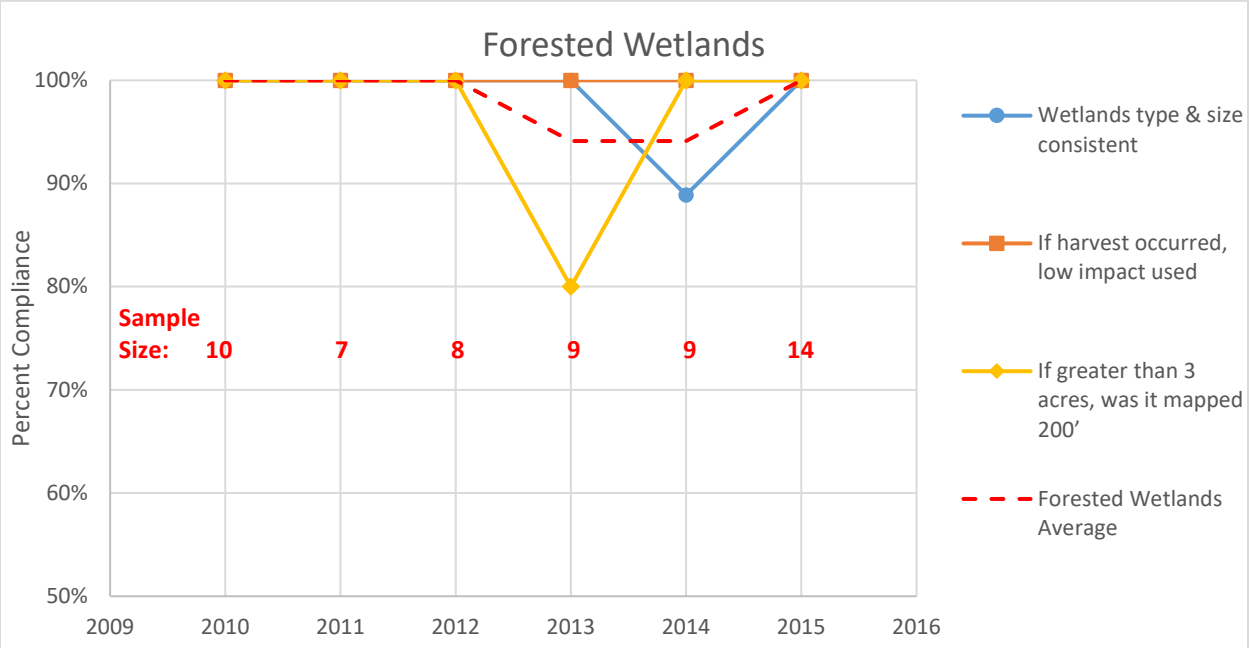
Non-Fish Bearing Seasonal Streams



A & B Wetlands



Forested Wetlands



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Hans Berge
Adaptive Management Program Administrator
Forest Practices Division
WDNR

Reviews for: (**ISPR 16-17_01)**
for WaDNR

Jun 1, 2017

Dear Hans Berge

Attached with this email you will find 4 files (besides a copy of this letter). One attached pdf file is the summarization by Associate Editor (AE), Dr. Loveday Conquest, of the reviews of "2014-2015 Biennium Forest Practices Compliance Monitoring Report-August 2016*"* for WaDNR. Three other attached pdf files are the three reviewers' comments. WaDNR asked for 3 reviewers to review this report. This was an 'open' type review (interaction between AE, reviewers and WaDNR). As stated by the AE about all the reviewers, they are ".. recognized scientists with combined expertise in statistics, quantitative ecology and resource management, forest biometry, and silviculture."

The Associate Editor and reviewers have presented their comments relative to the *revised* basic questions for ISPR's reviews for this Forest Practices Compliance Monitoring Report. In synthesizing the reviews, the AE stated that all the reviewers and she concluded that "*The statistical approach regarding the sampling procedure and construction of the ratio estimator for compliance is generally sound."* The AE went on to say that they *"recommend that a longer Appendix A containing the technical details of the sample selection procedure, including how one gets from the FPA, to the prescription, to the rules within the prescription, and ultimately to the estimate of compliance rate, be included."* Also that they "*strongly recommended that use of a "jackknifed" form of the ratio estimator be considered*." The AE and reviewers also included additional comments to consider for improvement of the compliance monitoring procedure.

If you have any other questions, let me know!

Sincerely

Daniel J. Vogt
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Synthesis and Assessment from Independent Scientific Peer Review (ISPR 16-17-01)

2014-2015 Biennium Forest Practices Compliance Monitoring Report

for the

Cooperative Monitoring, Evaluation and Research Committee (CMER)
and
Washington Department of Natural Resources (DNR)

by
Dr. Loveday L. Conquest
Associate Editor for the Independent Scientific Peer Review Committee

Executive Summary

The 2014-2015 Biennium Forest Practices Compliance Monitoring Report is a result of the analysis of data from a probability sample, based upon completed forest practice applications (FPAs) over the two-year period. For each of the various categories of similar forest practice rules (known as prescriptions): Roads, Type A&B Wetlands, Forested Wetlands, No Inner Zone Harvest [NIZH], Desired Future Condition Option 1 [DFC1], Desired Future Condition 2 [DFC2], Non-Fish-Bearing Perennial Stream [Np], Non-Fish-Bearing Seasonal Stream [Ns]), the statewide rate of compliance with the associated forest practice rules is estimated. Statewide compliance rate is also estimated for Haul Routes, whose sample is obtained in a different manner. (Details regarding the sample selection procedure and the estimator for compliance rate appear in the Responses to Questions below.)

The statistical approach regarding the sampling procedure and construction of the ratio estimator for compliance is generally sound. The Review Team and the Associate Editor recommend that a longer Appendix A containing the technical details of the sample selection procedure, including how one gets from the FPA, to the prescription, to the rules within the prescription, and ultimately to the estimate of compliance rate, be included. This needs to occur in order for anyone to attempt to reproduce the study or simply to truly understand the sampling selection and data analysis process. Some of the requested information could be gathered from current DNR documents. It would be helpful to see another chapter titled “The Life of a Completed FPA” (details below), but this is not as important as the need for an expanded Appendix A.

It is strongly recommended that use of a “jackknifed” form of the ratio estimator be considered. This could reduce bias and yield much better variance estimates. This would require additional

lines of code in the data analysis, but would not change the sample selection procedure. A jackknifed ratio estimator could also be applied to older data sets.

Review Process and Participants

A peer review was conducted through the Independent Scientific Peer Review Committee (ISPR) of the University of Washington (UW) of the 2014-2015 Biennium Forest Practices Compliance Monitoring Report for Washington State's Department of Natural Resources and for the Cooperative Monitoring, Evaluation and Research (CMER) Committee in spring 2017. The review team consisted of three peer reviewers and the Associate Editor (**AE**) Dr. Loveday Conquest (UW). Reviewers were selected by the **AE** in consultation with Dr. Daniel Vogt, Managing Editor (ME) of ISPR. In addition to reviewing the document, the Review Team met with the ME and DNR personnel (including an outside consultant for the DNR Compliance Program) in April 2017 to obtain further information and clarification on issues such as the sample selection procedure, the process for creating the database, and estimation of compliance rates.

The **AE** and the three reviewers are recognized scientists with combined expertise in statistics, quantitative ecology and resource management, forest biometry, and silviculture. Dr. Tamre Cardoso (**TC**) is a Principal Consultant with TerraStat Consulting Group and is a part-time Lecturer in the UW's Department of Statistics. For over twenty years, she has provided statistical consulting services for natural resource studies to both government agencies and private companies. Dr. James Flewelling (**JF**) is a consulting forest biometrician with extensive experience in growth and yield modeling, and forest inventory. Dr. Eric Turnblom (**ET**) holds the B. Bruce Bare Endowed Chair in Forest Resources and is Director of the Stand Management Cooperative in UW's School of Environmental and Forest Sciences. Turnblom is Associate Professor of Quantitative Silviculture and Forest Biometrics and has a long teaching career in forest measurements and statistics. Associate Editor Conquest is Director Emeritus of the Quantitative Ecology and Resource Management Program at UW, in addition to being Professor Emeritus of the College of the Environment's School of Aquatic and Fishery Sciences. A Fellow of the American Statistical Association, Conquest researched and taught experimental design and statistical methods for forty years through the Center for Quantitative Science in Forestry, Fisheries, and Wildlife.

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General Comments

It is helpful to set down a brief summary of the process concerning an FPA, from the time that it is filled out, to its role in the sample selection process. The **AE** concurs with Reviewer **ET's** following observations about the process concerning an FPA:

[1] A given FPA is filled out by a single entity (e.g., a forest manager, landowner, contracted firm) that pertains to one or more planned forest practices (e.g., building a road, implementing a DFC1 prescription). Each FPA involves a set of rules, although not every rule that could apply to an FPA actually does apply for that particular instance.

[2] Only completed FPAs in the stated biennial window (here, 2014-2015) are eligible for inclusion in the population for a particular prescription type in that biennium. A given FPA may contain a combination of forest practices. There may be more than one occurrence of a prescription type in a given FPA, and these multiple occurrences may not be statistically independent.

[3] The goal is to provide a statewide average compliance rate for each prescription. Compliance is defined as the proportion of correctly applied rules in the set of applicable rules used for that prescription.

[4] DNR wishes to select a statistically representative sample of prescriptions of a given type, as represented in completed FPAs. DNR also desires spatial coverage of landowner/contractor/operator combinations appearing in FPAs across the six regions of Washington. This process is coordinated with knowledge of DNR field effort available across the six regions.

[5] The sample selection process has several stages, beginning with a random selection of FPAs containing a given prescription. Completion of each FPA must be verified, applicable rules noted, compliant rules noted, ending with a compliance assessment for an instance of a forest practice event on the ground. Costs are incurred at each successive step.

[6] In keeping with considerations of labor costs and spatial coverage, within a given FPA, DNR samples a single instance of a prescription type, even if a prescription type appears more than once in an FPA. This maintains control over allocation of forest practice event samples to the six regions and also enables the balancing of the compliance assessment workload across regions.

The **AE** agrees with the three Reviewers that the current sample selection procedure should be maintained in order to have consistency through the years when assessing temporal trends in compliance rates.

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The List of Review Questions

Each reviewer was asked to specifically address the following twelve peer-review questions from CMER:

1. Are rigorous, transparent and sound research and statistical methods followed?
    a. Is the estimator used to estimate average compliance a proper statistical estimator?
    b. If the answer to a) is no, what estimator would you propose as an alternative estimate of average compliance for a prescription?
2. Is the statistical design (using the described estimator) a sound method for method for determining compliance with forest practices rules?
3. Is there sufficient detail in the document to reproduce the study?
4. Were data reasonably interpreted?
5. Do the literature citations include the latest applicable information and represent the current state of scientific understanding on this topic?
6. Are uncertainties and limitations of the work stated and described adequately?
7. Are assumptions stated and described adequately?
8. Is the information presented in an accurate, clear, complete, and unbiased manner and in a proper context?
9. Currently, there are several rules included in compliance calculations that are based on the proper classification of a site rather than on compliance with the rules specific to a particular classification. Thus, if an FPA is non-compliant for site class, the other rules are not applicable, so the FPA cluster has size one, with compliance = 0%. Because these FPAs have only one rule applied, they are not given high weight in the ratio estimate of average compliance. Specific questions:
    a. Does this amount to a bias in the estimate of average compliance for a prescription?
    b. If the answer to a) is yes, what would be the best way to remove this bias:
        i. Separate the compliance estimates into classification versus operational rules for those affected prescriptions
        ii. Change the method for estimating average compliance
10. Should compliance be calculated separately for administrative (site characteristics) versus layout and operational (on the ground) rule applications?
11. Recognizing there is a relationship between cost and sampling precision objectives, do you have suggestions for narrowing sampling statistic confidence intervals without significantly increasing the biennial sample size in order to improve the ability to discern trends over time?
12. What suggestions do you have for improving the clarity of the report narrative for an audience with general understanding of natural resources management: (1) the results of the report's two-year data; and (2) the description of trends?

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In these following responses to the questions, any citations referred to are references cited and presented in the Compliance Monitoring Report, unless otherwise noted. The response to Question 5 contains new literature citations with explanations. A list of references also appears at the end of this review.

1. Are rigorous, transparent and sound research and statistical methods followed?

There is general agreement that sound research and sound statistical methods are used. The underlying methodology uses a design-based approach; design-based estimators require no assumptions about the population. The ratio estimator used is well studied, nearly unbiased, and documented in many statistics textbooks (the Report references Cochran [1963, 1977] and Scheaffer et al. 1990). However, many of the details are not that transparent in the Report itself; hence the recommendation for an expanded *Appendix A*. As expected, things became much clearer for the Review Team following the meeting with DNR. See the response to Question 3 for suggestions regarding making more details about the statistical methods more transparent.

Reviewer **JF** argues for a clearer definition of the population of interest and of the population attribute of interest. Assuming that a site has been properly classified (addressed in Question 9), the Report states (p. 12), "For each riparian prescription, the population to be sampled consists of FPAs that included that prescription." The **AE** agrees with the Report; the issue of a valid sample selection process is addressed elsewhere. The Report (p. 2) states the (updated) method for calculating average compliance: "divide[s] the number of compliant rules by the number of total sampled rules within each prescription type, resulting in an average compliance rate." The issue of how to define a prescription's "overall compliance" arises because a given prescription type may appear more than once in an FPA. This is discussed below in the response to Question 1b.

a. Is the estimator used to estimate average compliance a proper statistical estimator?

Overall, the three Reviewers feel that as implemented, the ratio estimator used to estimate average compliance is a proper statistical estimator. When estimates rates or proportions are the objective, ratio estimators are often used. That said, there is room for improvement. The **AE** agrees with the statements by Reviewers **TC** and **JF** that ratio estimates carry some bias. **TC** points out that the amount of bias associated with the standard ratio estimator goes down on the order of (1/n) as the sample size n increases. For large n this is not a problem; for small n this could be problematic. To help reduce this bias, a jackknifed version of the ratio estimator in suggested below in 1b.

Another issue (noted by **JF**, **TC**, and the **AE**) arises from the use of the standard finite population correction, (1 – n/N), where n is the sample size and N is the population size. What is used in the calculation of standard errors is $\widehat{N}$, the estimated population size as shown in the Report's Table 2 (p. 15). This adds another random component to the formula for the standard error of $\hat{p}$, the estimated proportion of compliance for a given prescription. Thus, SE($\hat{p}$) in the Appendix should really denoted as $\widehat{SE}(\hat{p})$. Reviewer **JF** offers further comments concerning the (estimated) proportion sampled, that as n approaches N (which means that the sample selection is approaching an actual census), n/N will approach 1.0 and the calculated standard error will approach zero. The (estimated) proportion sampled for the prescription types in Table 2 are respectively (excluding Haul Routes): Roads 0.01, Ns 0.03, Np 0.04, Type A & B Wetlands 0.15, Forested Wetlands 0.07, NIZH 0.03, DFC1 0.36, 0.09. The maximum value of 0.36 is that for DF1, so there does not appear the possibility of attaining a zero standard error. Regarding the statement from Reviewer **JF**: "[T]he formula for standard errors is correct only if the population of interest is defined as the set of prescriptions consisting of one prescription on each FPA having exactly one prescription of a given type, and a randomly selected prescription from every FPA having more than one prescription of that type", the **AE** agrees with the definition from the Report's p. 12 (stated above). The number of prescriptions of a given type contained in an FPA is rather an issue of subsampling; all FPAs containing at least one prescription of a given type are included in the population to be sampled.

b. If the answer to a) is no, what estimator would you propose as an alternative estimate of average compliance for a prescription?

TC suggests the use of a jackknife ratio estimator (Cochran 1977, cf. p. 175) to help reduce potential bias in estimating average rule compliance for prescriptions using a smaller number of FPA samples. In this scenario, for a given prescription, jackknife estimation would require recalculation of ratio estimates leaving out one FPA each time. For example, if there were 13 FPAs being used to estimate DFC1 compliance, 13 ratio estimates would be calculated from the data, using 12 FPAs per estimate. The 13 estimates would then be averaged to come up with a less biased estimate of DFC1 compliance. Estimator variance may increase for the jackknifed ratio, but only on the order of $1/n^2$ (Cochran 1977). Use of the jackknife would not necessarily reduce any bias to zero. However, jackknife ratio estimates could be compared to original ratio estimates to, say, determine the sample size at which the difference between the two becomes negligible. The **AE** concurs and believes that further evidence from forestry studies (see Question 5) promotes the use of the jackknife estimator here. Additional coding steps would be needed to obtain the estimator and the associated variance; the **AE** sees this as entirely doable. Jackknife ratio estimates on datasets from previous years could also be calculated.

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In Reviewer **JF's** response to Question 1 and Appendix A (not to be confused with Appendix A from the Report itself), "Compliance percentage: definition and estimator", **JF** considers two different ways of calculating the compliance estimate. The first estimator involves weights that vary according to the number of times a prescription type occurs in an FPA. The second one is the one used by DNR. For illustration, considering a small population of four FPAs, suppose only two are sampled for a given prescription, yielding six possible combinations ("4 choose 2" = 6) of FPAs being chosen. Some FPAs indeed have more than one occurrence of a prescription type, and according to DNR sampling protocol only one of the multiple occurrences is sampled. Since here one is looking at the entire population of four FPAs, the actual compliance for the population can be computed under **JF's** Option A and Option B. Further, the expected value of each of the two estimators (based on all possible samples of two FPAs) can also be computed. Each estimator yields an expected value close to its population value for this defined population. For a single FPA, if all prescriptions of a given type were sampled, the compliance estimate would be the same for both estimators. As an example, consider FPA 2 from **JF's** example, with a double occurrence of a given prescription. There are 6 and 5 rule applications respectively, and 4 and 4 compliant rule applications respectively. One can compute the compliance rate as:
(# of compliant rule applications)/(# of rule applications) = (4+4)/(6+5).
Alternatively, one can compute the compliance rate as:
(average # of compliant rule applications)/(average # of rule applications) = ((4+4)/2) / ((6+5)/2).
The answer is the same, 0.73, in both cases. However, when they are summed up over than one FPA (summing up the "straight number" of occurrences in both numerator and denominator versus summing up the average number of occurrences in both numerator and denominator), the numbers do change. **JF's** discussion following the computations notes that the choice between the two estimators is really administrative rather than statistical (the **AE** concurs and therefore there is no reason to change from the current ratio estimator). **JF** further notes DNR's desire to spread the sampling out among FPAs, rather than allowing multiple prescriptions of the same type to be sampled from the same FPA.

Reviewer **JF** also offers an alternative calculation to the finite population correction (FPC, currently based on n/$\widehat{N}$, # of sampled FPAs containing one or more of that prescription type/estimated FPA population size for that prescription type). **JF** suggests using a single, overall FPC: # of sampled FPAs/estimated FPA population size. If each FPA had at most one occurrence of a prescription type, these two FPCs would be the same. (As an alternative, **JF** recommends calculating a variance first assuming an infinite population, then reducing the variance using an FPC whose value is known with certainty; but this would necessitate knowing the exact count of a given prescription type). The **AE** notes that the crux of this issue has to do with, when a prescription type occurs more than once in a single FPA, how representative a

single prescription (chosen at random) for analysis is of the other prescriptions of that type that did not end up in the sample. If multiple prescriptions of the same type in an FPA are "well mixed", the random sampling argument may be all that is needed. The **AE** sees no association between the number of occurrences of a prescription type in an FPA and the prescription's compliance rate for that FPA.

JF's discussion noted, the **AE** concludes that DNR's present use of the ratio estimator is still a good way for DNR to proceed, with the added recommendation noted above that DNR consider using a jackknifed version of the present ratio estimate.

2. Is the statistical design (using the described estimator) a sound method for determining compliance with forest practice rules?

Recognizing the need to meet objectives for compliance monitoring while staying within the bounds of budget constraints, the Review Team agrees that the statistical design is a sound method for the eight standard prescription types. Furthermore, sampling proportional to available regional effort should result in a random sample of FPAs with statewide spatial coverage.

The FPAs are clusters (in the statistical sense) of prescriptions, since a given FPA may contain a variety of prescriptions. It is also true that two or more prescriptions of the same type may contain different rules, and differing numbers of rules. DNR states that a prescription is itself a "cluster of rules", since the number of rules is random and since the particular rules may differ. The **AE** agrees with Reviewer **TC** that it is nonetheless important to note that the sample selection procedure is still single-stage cluster sampling and not two-stage cluster sampling, since (for a given prescription type) the random sample is a sample of FPAs containing that prescription. Reviewer **ET** refers to the sampling procedure as a "modified single-cluster sampling strategy" (the modification being how multiple occurrences of a prescription are handled), which the **AE** views as a good way to describe things. While some may view this point as largely an issue of "statistical semantics", the Report must do all it can to provide clarity on what exactly is involved in the sampling procedure.

"Haul routes" is different from the standard prescription types, since for efficiency reasons haul routes are sampled on a subset of FPAs that have already been selected for other prescription compliance sampling. (In the example given on the Report's p. 49, haul routes were observed on FPAs selected for the harvest prescription sample.) Thus, one may question whether the harvest-prescription-based haul route sample is statistically representative (in the way a random sample of FPAs with haul route prescriptions would be) of the haul route prescription applications throughout the state. The Report does make note of this, for example, when it points out that

there is no population estimate for haul routes (p. 15). But Table 16 (p. 49) lists haul route CIs for percent compliance and other parameters in the standard "assuming a random sample" way. While the **AE** does not recommend deletion of these CIs for haul routes, a qualifier similar to that on p. 15 should be added here too.

3. Is there sufficient detail in the document to reproduce the study?

In its present form, the Report does not provide enough detail to reproduce the study. This statement holds both for obtaining the random sample of FPAs for a prescription across the six regions throughout the state, and for using the data from the sample to obtain an estimate of compliance. The 2 ½-hour meeting with DNR in April 2017 (including handouts, and discussions around schematics drawn on a whiteboard) proved extremely helpful in deepening the Review Team's understanding of the Compliance Monitoring Program. Without that meeting, the Review Team would not have been able to properly interpret the Report.

The Review Team is keenly aware that the Report must serve a variety of audiences. Thus, it would not be a good idea to add to Chap. 4 the extensive level of statistical detail required to completely understand the sampling process and how to get to the compliance estimates. This is better done in the Report's Appendix A. An expanded Appendix A could include:

[1] a description of the random selection of the FPAs for a given prescription, including the stratification across Washington State's six regions for purposes of spatial coverage and labor efficiency;

[2] an explanation of why the simple random sampling estimate approach, even though the sample was obtained via stratified random sampling, "works" statistically (as was explained at the meeting and via handouts);

[3] an example for the "roads" prescription, from sample selection to obtaining the compliance estimate from the sample (because the way roads compliance is measured is slightly different from the other prescriptions;

[4] a further example for a prescription other than roads, where each applied rule is scored as either a 0 or a 1;

[5] an example of how sample sizes are determined. Much of this is in the information that was conveyed to the Review Team at the meeting with DNR. The handouts and notes from the meeting could be used as a starting point for expanding Appendix A, which could be updated yearly or biennially. To minimize additional writing effort, the **AE** notes that information similar to the handouts is available in existing DNR publications, which could be referenced with specific page numbers. For example, pp. 11-13 of the DNR Compliance Monitoring Program Description (Lingley et al. 2010, see Question 5)

lists the sample selection steps in place at that time, along with a flow chart. An updated version of this was presented at the meeting with DNR staff.

Ideally, the Report, with its current appendices and the expanded Appendix A, could allow the entire compliance assessment process, from creation of the samples to obtaining the estimates, to be reproduced in another part of the country where FPAs and prescriptions are used. The **AE** concurs with the Reviewers that while this request may appear to call for an excessive level of documentation, the documentation would also serve as the basis to explore other sampling designs and estimation methods.

A suggestion for another Appendix is the inclusion of "The Life of a Completed FPA". This would take a particular completed FPA through the entire process. A listing of its associated prescriptions would reveal in which populations of prescriptions this FPA would end up. For each unique prescription, the computing of the compliance rate could be illustrated. For a prescription that appears more than once, one would be chosen at random and its compliance rate computation illustrated. The Review Team saw schematics illustrating some of this at the DNR meeting. It certainly would be helpful to anyone trying to get a firm grip on the sampling process, what kinds of data go into the database, and the process to get to the compliance estimates. The written summary from the meeting with DNR would be a good start on such an Appendix.

4. Were the data reasonably interpreted?

The **AE** concurs with the Reviewers that the data do appear to have been reasonably interpreted. The report presents a summary of rule compliance rates, with 95% CIs by prescription types. The Report does not judge whether a stated level of compliance is "good" or "bad". That interpretation is left to those who will make use of the Report, which is as it should be. The **AE** notes that the additional information categorizing the level of deviation from compliance, and the level of compliance, was illustrated very well.

5. Do the literature citations include the latest applicable information and represent the current state of scientific understanding on this topic?

For the most part, yes. The **AE** will not attempt to add to the Report's list of texts on sampling, except to note that for readers who find the level of mathematics in Cochran (1977, the classic sampling text) difficult to digest, Scheaffer et al. (1990) provides a good starting point to understanding sampling, including cluster sampling and stratified sampling. A reference from

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Reviewer **TC** regarding use of the jackknife statistic in forestry is given below. Three references from Reviewer **JF** dealing with applications, effectiveness, and compliance with forestry management practices, including sample selection procedures, are also presented. The **AE** has added Lingley et al. (2010), a DNR publication. Each reference appears with a descriptive comment.

Gregoire, T.G. 1984. The jackknife: an introduction with applications in forestry data analysis. *Canadian Journal of Forest Research 14(4)*: 493-497.
This article introduces the notion of a statistic called the "jackknife" (due to its handy nature requiring no further additional sampling), and illustrates its usefulness in terms of a ratio estimator in forestry applications, completely relevant to DNR's Compliance Monitoring Program.

Egan, A.F., R.D. Whipkey and J.P. Rowe. 1998. Compliance with forestry best management practices in West Virginia. *Northern Journal of Applied Forestry 15(4):* 211-215.
This study features a well-defined sampling frame: "The focus was to randomly select harvested sites for investigation. . . . Based on records developed from logging operation notification forms, sites were randomly selected from lists of retired operations provided by each of the six WVDOF Forest Districts." This is the sample selection procedure used later by Wang and Goff (2008).

Phillips, M. J. and C. R. Blinn, 2007. Practices evaluated and approaches used to select sites for monitoring the application of best management practices: a regional summary. *Journal of Forestry 105(4):* 179-183.
This survey article summarizes various state monitoring programs. Because they are so different, the idea of a "compliance monitoring clearinghouse" is put forth, along with regional meetings among natural resource managers and agencies. A clearinghouse would "permit states to compare and contrast approaches and to share information about what does and does not work," with the goal being continuous improvement of states' programs.

Wang, J. and W.A. Goff, 2008. Application and effectiveness of forestry best management practices in West Virginia. *Northern Journal of Applied Forestry 25(1)*: 32-37.
This article reports the results of a compliance monitoring program in West Virginia. The program bases its sample selection process on Egan et al. (1998).

Lingley, L., A. Shelly and W. Obermeyer. 2010. Washington State Department of Natural Resources Compliance Program Description. 34 pp.
Material from this document could be added to the recommended expanded Appendix A. Appears as a .pdf under http://www.dnr.wa.gov/programs-and-services/forest-practices/rule-implementation

6. Are uncertainties and limitations of the work stated and described adequately?

Generally, yes. For the prescriptions whose samples were obtained by random sampling from a population of FPAs containing a given prescription type (this excludes haul routes), the 95% CIs are quite suitable for describing the uncertainty. Limitations such as the use of professional judgement or potential biases in estimates are noted many times throughout the report, to the authors' credit.

Reviewer **JF** would like to see an estimate of the number or proportion of FPAs not considered for sampling due to one or more prescriptions being incomplete. **JF's** Appendix B offers further comments regarding keeping this number as low as possible, including revisiting an FPA in a subsequent year to assess completion, or by each FPA having a completion date recorded. If budgetary constraints allow, the **AE** encourages DNR to find a way to include the completion date information, which would essentially make this a non-issue.

7. Are assumptions stated and described adequately?

For the most part, yes. Various assumptions are noted in the Report and seem clear. Reviewer **JF's** comments regarding the definition of percent compliance are under Question 1. See Question 12 below regarding some extra statements needed regarding the weighted regression model in Chap. 7. For the sample selection procedure and computation of compliance rate, the assumptions would probably appear in Appendix A.

8. Is the information presented in an accurate, clear, complete, and unbiased manner and in a proper context?

The **AE** concurs with the Reviewers that the answer is "Yes". The report is logically organized, and the history and context is useful for readers with less familiarity with the objectives of the Compliance Monitoring Program. The **AE** echoes the comment from Reviewer **ET** that the context and tone of the Report are outstanding. Considerable effort by the authors has been made to present results for the reader without any "editorial spin".

That said, the Review Team reiterates that Chapter 4, Compliance Monitoring Design and Methodology, needs its expanded Appendix A so that interested readers (who may actually wish to reproduce the study) can get the technical details (including diagrams) on determining sample size, selecting the sample using random sampling of FPAs containing a particular prescription,

estimating the compliance rate, and computing an accompanying CI for the rate. To save effort, the **AE** recommends the use of text and diagrams from existing DNR documents.

Reviewer **JF** suggests that more details might appear in Appendix C: Trends of Individual Rules. These are presented without counts of individual rule applications, nor level of compliance. Nonetheless, they allow a reader to look for possible trends, or to see which rules do better than others in terms of compliance over the years. (*The **AE** notes that overall level of compliance can be read from the graph without too much difficulty*). **JF** recommends including a table of results by individual rule, including the number of rule applications assessed, the compliance rate, and counts by the various levels of compliance, thus allowing the reader to see which rules were causing problems. The **AE** notes that Appendix B does contain compliance information on certain rules (Standard Sample rules, Site Class, Physical Criteria of Waters, and others); however, the "roads" prescription is not included. In Appendix C, the number of FPAs sampled is given, but not the number of rules monitored. The **AE** agrees that this would be useful information if labor costs permit.

9. Currently, there are several rules included in compliance calculations that are based on the proper classification of a site rather than on compliance with the rules specific to a particular classification. Thus, if an FPA is non-compliant for site class, the other rules are not applicable, so the FPA cluster has size one, with compliance = 0%. Because these FPAs have only one rule applied, they are not given high weight in the ratio estimate of average compliance. Specific questions:

a. Does this amount to a bias in the estimate of average compliance for a prescription?

That depends upon how often this occurs. From the DNR meeting, the Review Team got the idea that this does not occur very often. Reviewer **ET** views this as less a question of bias and more of a question of information (rules other than site classification) not being allowed to be used. At any rate, occurrences like these (with the resulting 0% compliance estimate) would not contribute to any upward inflation of a compliance estimate, but rather the opposite. Rare instances of misclassification should have little downward effect on a compliance estimate. The **AE** concurs with Reviewer **TC** that frequent classification errors could lower the estimate of compliance rate, not from actual lack of compliance with forest practices, but from errors in classification; this could be more pronounced for prescriptions with smaller sample sizes. In terms of looking for temporal trends, it is likely the case that the data for each biennium would have the same small proportion of FPAs wrongly classified for site class. Thus, any downward effect present would likely be the same from year to year.

b. If the answer to a) is yes, what would be the best way to remove this bias:

i.) Separate the compliance estimates into classification versus operational rules for those affected prescriptions.

The **AE** concurs with the Reviewers that FPAs that are non-compliant for site class should be separated out. Reviewer **JF** notes that if analyzed, this separated group would likely exhibit small sample sizes, so confidence intervals should not be required. To what degree they should be further analyzed depends upon whether DNR feels that it makes sense to assess operational rules for compliance on a misclassified prescription (**TC**).

The **AE** concurs with Reviewer **TC** that if an FPA is found to be non-compliant for site class, it could be discarded and another one further down the list of FPAs (recall the list is in a random order) substituted instead. This essentially changes the population of inference for a given prescription to "those FPAs classified correctly with respect to site class". Misclassified FPAs could be tracked and percentages reported. Simulation could be used to look at effects of varying levels of misclassification on compliance rate estimates. See also the response to Question 10.

ii.) Change the method for estimating average compliance.

No. The Review Team agrees with that exceptions need to be noted, but a consistent method to estimate compliance over all prescriptions is essential.

10. Should compliance be calculated separately for administrative (site characteristics) versus layout and operational (on the ground) rule applications?

Reviewer **JF** refers the reader back to Question 9, and Reviewer **ET** asks for more specifics. Reviewer **TC** notes that this should be an easy exercise to test but that the question, "how will the resultant compliance rates be used?" should be answered first.

The **AE** offers the following: to investigate this issue, let us assume that there is interest in presenting compliance rates for [1] administrative; i.e., noting correct site characteristics, separate from [2] on-the-ground rule applications. There would be additional effort involved in classifying each rule as (say) "A for Administrative" vs. "L for Layout/Operational" and entering this information into a database. Then, for a given obtained sample of FPAs for a prescription, compliance rates could be estimated for both "A" type rules and "L" type rules. However, the number of rules (i.e., the denominator of the compliance estimate) for each rule type, "A" or "L", would naturally be smaller than that for the combined "A + L" set of rules. Smaller denominators lead to larger variance estimates, which could have an effect upon the stated +/- 6% error desired in a 95% CI (**TC**). If larger sample sizes are needed, that means sampling more FPAs for a given

prescription—more effort and more labor costs. Thus, one needs to think about how the separate compliance rates would be used, and if any particular forest land management practices or procedures might change as a result. If little change would actually result, then the additional effort required to get information into the database for the separate calculations may not be worth the effort.

One way to gauge additional labor costs would be to choose a prescription and actually use the above procedure on currently existing data to generate separate compliance rates for that prescription. That would also yield an example of by how much sample sizes decrease when the rules are split into "A" and "L" types.

11. Recognizing that there is a relationship between cost and sampling precision objectives, do you have suggestions for narrowing sampling statistic confidence intervals without significant increasing the biennial sample size in order to improve the ability to discern trends over time?

The data points necessary to improve the ability to discern trends over time are simply--more time points, which means more years of data. Over short time periods, trends have to be quite strong (big year-to-year changes) in order to be detected (**TC**). Without more years of data, the only way to narrow the CI would be to lower the level of confidence to, say, 90% from 95%. This would be an administrative rather than a statistical decision. If there are prescription types that are more important than others, Reviewer **JF** suggests that the target confidence intervals and sample sizes could be changed to better focus on the prescription types most in need of improved compliance information. If administrative changes allowed for the recording of actual FPA completion dates, and all review and monitoring occurred after those recorded dates, less effort would be spent in visiting unsuitable sites, and the population of interest would be better defined. The **AE** adds that if differing levels of confidence are used (say, both 90% and 95%) and/or differing levels of the allowable error (e.g., +/-5% and +/-6%), DNR will have to provide good reasons for this.

Review of ISPR 16-17-01
2014-2015 Biennium Forest Practices Compliance Monitoring Report
AE Synthesis – L Conquest

12. What suggestions do you have for improving the clarity of the report narrative for an audience with general understanding of natural resources management: (1) the results of the report's two-year data; and (2) the description of trends?

(1). Results of the Report's two-year data.

The reader is referred back to the response to Question 8. Review **JF** adds that tables showing results by individual rule could be helpful. The **AE** concurs, keeping in mind the need to balance the benefit of DNR and others being able to view results to that level of detail, versus the cost to produce them.

(2). The description of trends (Chap. 7 of the Report).

Some clarification is required in the Methods section of Chap. 7 regarding the regression method used. The word "multivariate" should be dropped from paragraph 2 under Methods (p. 50, paragraph 2, lines 1 and 6), as it caused more than one Reviewer (and the **AE**) to wonder whether the response term consisted of a multivariate vector. It was clarified at the DNR meeting that for each of the eight prescription types, the response variable in the weighted regression analysis is the statewide percent compliance. Also, since this is "ordinary weighted regression", that means the usual assumptions about the error structure are present; therefore they should be clearly stated. That includes normally distributed (i.e., Gaussian) random error, but with nonhomogeneous variance. Paragraph 2 discusses the nonhomogeneous variance and the structure of the weights, so the only things requiring specific mention are the assumed normal distributions and the independence of the random error terms.

A suggestion that has come up in discussion is considering the use of logistic regression. This could be appropriate for those prescriptions where compliance rate is the ratio of two integers. A quick way to assess the feasibility of this would be to plot the logit of compliance rate (log(p/(1-p)) against time to see if things tend to "look more linear" than before. If so, logistic regression might be appropriate, or even ordinary weighted regression using logits instead of the rates themselves as the response (this from the **AE**). Still, this will not make up for the small number of years available to assess trends.

Page 9 of the Report and comments at the DNR meeting have made it clear that DNR is not focusing on individual regions, but rather statewide. If in future DNR is interested in regional variation regarding compliance rates, then the following comments from Reviewer **JF** may be pertinent (details may be found in **JF's** response to Question 12):

Reviewer **JF** posits a hypothesis that every rule has a constant compliance rate over time, but that rate may vary by region (space). If that were the case, then depending upon the regional

distribution of FPAs, variation (possible trends) in the rate of compliance over space (regions) might be interpreted as variation (possible trends) over time. A statistical model is offered with terms for region, rule, and year, which could potentially be analyzed via logistic regression, using random effects to account for the fact that various rules within a given prescription would likely be correlated.

References

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Phillips, M. J. and C. R. Blinn, 2007. Practices evaluated and approaches used to select sites for monitoring the application of best management practices: a regional summary. *Journal of Forestry 105(4):* 179-183.

Wang, J. and W.A. Goff, 2008. Application and effectiveness of forestry best management practices in West Virginia. *Northern Journal of Applied Forestry 25(1)*: 32-37.

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2014-2015 Biennium Forest Practices Compliance Monitoring Report
AE Synthesis – L Conquest

Comments to Specific Pages in the Report

Regarding color coding found below and in the Reviewers' Comments:
Green = recommend for consideration to improve the manuscript,
Turquoise = strongly suggested for improvement,
Yellow = required change to the manuscript.

From Reviewer TC (also listed under **TC's** Comments):

1) Page 2, second paragraph under "Changes in Study Design" change last sentence to correctly reflect the applied regression methods to something like, "Weighted least squares linear regression was used to assess general trends in average compliance rates through time."
2) Page 2, footnote 1. A 95% CI means that if the sample was repeated 20 times … The +/- 6% has nothing to do with the interpretation of the confidence level. The +/- 6% is the targeted margin of error that is used to estimate requisite sample sizes.
3) Page 7, paragraph under "Reports". Last sentence, add "that" before are detailed in this biennial report.
4) Page 12, "Sample Selection" section. Needs to reference a new Appendix or specific sections of an expanded Appendix A.
5) Page 12, second to last paragraph, last sentence. May want to explain rationale behind the statement, "Sample sizes are applied in proportion to region population size for each prescription size." During the meeting, I left believing that regions only enter the sample selection as a means to distribute effort, and regions are not really strata of interest.
6) Page 14, first paragraph. Need to decide if rules per prescription are going to be referred to as clusters. The primary level of sampling are FPAs and FPAs are treated as clusters in the sampling sense. To alleviate any confusion with two-stage cluster sampling, you may want to refer to groups or sets of rules per prescription. It's a bit confusing because the mean number of rules per prescription is used in the sample size estimation procedure.
7) Page 16, first paragraph under "Compliance Assessment and Ratings". Reference any updated/new Appendix with details/example.
8) Page 17, first paragraph, last sentence. Change "…that to the method of sampling." to "…than to the method of sampling."
9) Page 39, Table 9 and first paragraph after the table. Change Np water Compliant from 93.4% to 94.1%. Similarly, change the value in the first sentence of paragraph below the table. The value reported in Table 5, page 30 appears to be correct.
10) Page 50, second paragraph under "Methods" section. Update to reflect regression method that was applied, weighted least squares regression of compliance rate on time.

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From the AE:

1) Page 12, Changes in Study Design, 2nd paragraph, delete "multivariate" so that it reads "Weighted least squares linear regression analysis …".
2) Page 16. Keep the CIs for haul routes but add a qualifier similar to that on p. 15.
3) The word "multivariate" should be dropped from paragraph 2 under Methods (p. 50, paragraph 2, lines 1 and 6)
4) In Appendix B, whenever only a single rule occurrence has been assessed, the resulting compliance percentage is either 0% or 100%, and there should be no accompanying 95% CI. This is displayed correctly once under DFC1 and once under NIZH. However, under A & B Wetlands, a 95% CI appears for "Openings less than 100' wide" even though only a single rule has been assessed; the CI here should read "n/a".
5) For NIZH "Observed CMZ", two rules have been assessed with 0% compliance. Even with only two rules assessed, a (wide) 95% CI should still be calculable, as for "Unstable slopes bounded out" in DFC2.
6) Also in Appendix B, the results for the "Roads" prescription are missing. If there is a valid reason for this, it should be stated.

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MEMORANDUM

January 26, 2018

TO: Forest Practices Board

FROM: Hans Berge, Adaptive Management Program Administrator

SUBJECT: Quarterly Staff Report

This memo highlights work completed and progress made in the Adaptive Management Program (AMP) since the November 2017 Forest Practices Board Meeting. The areas of emphasis for this quarter include updates on two active proposal initiations (PI), prioritization of research projects, and an update on the facilitation contract for caucus principals.

Proposed Alternate Plan Template submitted by WFFA

The report to the Board in November focused upon a timeline that included work by a contractor to address questions and concerns from Policy around the science used to support the WFFA's template proposal. Since the Board's meeting, there has been a significant change, the contractor is no longer working on the project and the subcommittee of Policy directing the work is discussing options to maintain the timeline. The next steps are to continue the "science track" in evaluating the science used to support the proposal as well as the "policy track" to determine whether or not the proposal meets the criteria necessary to qualify as a template. I expect to have a report to the Board by the August 2018 meeting.

Unstable Slope

Policy is waiting until the Unstable Slope Scientific Advisory Group (UPSAG) gets approval from CMER to review their research strategy for deep-seated landslides. Once Policy receives the strategy, they will determine how to resolve those elements contained in the PI that have not been addressed. I expect an more complete update for the May 2018 Board meeting with a timeline that includes the final report on the PI.

AMP Priorities

I am happy to report that Policy has been working on a method to prioritize research projects for the master project schedule and budget that will help the Adaptive Management Program ensure

that we are making progress on the highest priorities. Updates on this work will be provided in May and will result in a more up to date master project schedule and budget moving forward.

AMP Improvements

The AMP Improvement subcommittee of the Board interviewed potential facilitators to work with the caucus principals to improve the program. Following those interviews, I am happy to announce that the Meridian Institute (facilitator Connie Lewis) was the successful candidate. Connie has a great deal of expertise in facilitation complex topics, including work with the advisory group on the Tongass National Forest. We have a fully executed agreement in place and the subcommittee will be meeting with Connie soon to start work on this important project.

It has been a very busy quarter for the AMP. If you have any questions, please feel free to contact me (hans.berge@dnr.wa.gov or 360-902-1909).

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January 10, 2018

TO: Forest Practices Board

FROM: Marc Ratcliff, Forest Practices Policy Section

SUBJECT: Board Manual Development Update

This memo provides information on the anticipated development of the Forest Practices Board Manual.

Section 23, *Guidelines for Field Protocol to Locate Mapped Division between Stream Types and Perennial Stream Identification (Part 1 – Divisions between Type F and N Waters).* Within the last year and a half, the Board has accepted a number of the TFW Policy Committee work products and recommendations for inclusion in the development of guidance to identify the break between Type F and N Water. This guidance, to be located in board manual section 23 Part 1, will accompany the permanent water typing rule. Short of accepting the last remaining element for the new rule—the potential habitat barrier (PHB) recommendations—the Board requested staff present all Board approved elements for use in the development of guidance at the February 2018 meeting. Focused language development for Part 1 will occur after the Board accepts the final PHB metric recommendations, which will accompany and inform the fish habitat assessment methodology.

The attachment document contains a summary of the Board accepted materials and guidance concepts for use in developing Board Manual guidance. The list represents the items/decisions the Board has accepted and approved for inclusion in guidance.

DNR develops the Board Manual in cooperation with other timber, fish and wildlife partners and solicits Policy representatives having specific expertise for the review of these sections. Based on the assumption the Board will accept the revised potential habitat barrier recommendations at the February meeting and set forth direction for completing guidance, I have reached out to Policy caucus leads to provide the names of those assisting with this effort. The meetings will begin shortly after the February Board meeting. A review of the draft materials will be shared after DNR initially develops the conceptual outline and incorporates the elements the Board has accepted to date.

The approval of Board Manual Section 23 (Part 1) and the subsequent removal of the guidance in Section 13 (Guidelines for Determining Fish use for the Purposes of Typing Waters) will coincide with the adoption of the permanent water typing rule anticipated for August.

Section 23*, Guidelines for Field Protocol to Locate Mapped Division between Stream Types and Perennial Stream Identification (Part 2 – Divisions between Type Np and Ns Waters)*
Part 2 involves guidance for locating the division between Type Np and Ns waters, otherwise known as locating the upper most point of perennial flow. In October 2017, Policy reached agreement for the steps needed to complete this guidance. Policy recommended DNR work with stakeholders to complete both a remote and in-field methodology for establishing the upper most point of perennial flow. Development of Part 2 will occur when the Type F habitat delineation processes in Part 1 is complete.

Section 12*, Guidance for Application of Forest Chemicals* – In response to several rule petitions and concerns regarding aerial application of forest chemicals, the Board directed Forest Practices staff to meet with stakeholders and seek solutions where possible. The work group was able to recommend some application improvements and voluntary outreach opportunities. One of the recommendations includes updating Section 12, which has not been updated since 2002. Development of Section 12 will not occur until both parts of Section 23 are complete. The Board's 2018 work plan will need to be amended to reflect this change.

Please feel free to contact me with any questions at 360.902.1414, or marc.ratcliff@dnr.wa.gov.

MR

Board Approved Reports and Materials Regarding Board Manual Section 23 Guidance

This document provides a summary of the work products and recommendations (in chronological order) provided to the Forest Practices Board by the TFW Policy Committee, and the Board's subsequent direction related to the development of Section 23. This represents materials and conceptual elements the Board has accepted for inclusion into guidance. Not all discussions or requests for guidance within these documents received final resolve. Only those concepts receiving consensus or general agreement are provided in this summary.

1. Recommendations of Best Practices Regarding Protocol Survey Electrofishing - Results of the Electrofishing Technical Workgroup for TFW Policy Committee, June 27, 2016

An electrofishing technical group was tasked with identifying best management practices for conducting electrofishing surveys. The document contains the group's attempt to answer several questions submitted by Policy members in relation to the use and effectiveness of protocol surveys. Their report provides conclusions and discussions, followed by specific recommendations that will aid the development of protocol survey guidance. For brevity, a sample of the group's conclusions are shown below:

- Careful attention to electrofishing techniques minimizes risks to individual fish
- Use electrofisher settings appropriate for a stream's conductivity
- With proper training, experience, and equipment, direct harm from electrofishing can be minimized
- [Surveyors] currently have several options to reduce site-specific impacts of single visit surveys
  - follow protocol electrofishing survey guidelines using the best available equipment and careful survey procedures,
  - use visual observation prior to electrofishing,
  - coordinate with WDFW, local Tribes, [etc.] to determine what surveys have already been performed
- Electrofishing surveys are generally effective at detecting fish during low flow conditions when those flows fall within the normal long-term range for a given stream and time of year
- Electrofishing surveys are generally effective at detecting fish in streams greater than 5-feet bankfull width
- Electrofishing surveys conducted over a distance of ¼ mile upstream from the last detected fish are generally sufficient to indicate fish absence with a high probability
- Multiple protocol electrofishing surveys conducted on a single stream segment are not generally needed to indicate fish absence
- Electrofishing surveys are generally effective in stream reaches above man-made barriers where viable fish populations exist, and where the abundance and/or species composition of fish within that reach does not appear to be influenced by the presence of the man-made barrier and appropriate environmental factors exist
- The probability of detecting fish in headwater streams using protocol electrofishing surveys can be influenced by population density and numerous other factors previously mentioned above, but is generally not poor
- Multiple electrofishers are not generally required when conducting protocol electrofishing surveys in streams larger than 5-foot bankfull width

- The current [survey] window as defined by Board Manual 13 (March 1-July 15) is appropriate in most cases for western Washington
- Vary survey approaches when encountering different species and/or life stages. If unfamiliar with the life history traits of target species, consultant with WDFW and affected tribes prior to conducting surveys
  - for ESA-listed species, adherence to NOAA electrofishing guidelines [is required]
- [For streams with disturbance/habitat degradation] consultation with DNR, Ecology, WDFW and affected tribes is the best way to ensure survey results are accepted
- Board Manual 13 addresses [surveys above man-made barriers] and recommends using physical criteria unless otherwise approved by DNR in consultation with WDFW, Ecology, and affected tribes in these cases
- Electrofishing surveys are not the preferred tool for establishing fish presence in ponds and wetlands, especially those that are not wadeable. Protocol electrofishing surveys are not applicable to defining off-channel habitats under current rules
  - other methods (minnow trapping, seining, hook and line sampling, etc., or a combination of multiple sampling techniques) are likely to be more appropriate in ponds and wetlands
- Surveys in headwater and small tributary streams simply cannot meet the qualifying pool criteria, as sufficient numbers of qualifying pools are not present in the surveyed reach. Surveyors should sample and document the pool habitat that is available

2. Review of Off-Channel Habitat Protection under the Current Washington Forest Practices Rules, August 31, 2016

The AMPA formed a scientific group to evaluate the adequacy of the forest practice rules in delineating and protecting off-channel habitat. Although the group agreed the current process to delineate off-channel using bankfull flow elevation is appropriate to capture most situations, the report recommends additional research to determine if off-channel habitat is excluded in any form. The author's description of off-channel habitat and fish dependency may be useful in describing these habitats in guidance.

3. Technical Working Group Recommendations to Assist in the Development of Type F Habitat Guidance, October 2016

The AMPA formed a technical work group to provide recommendations to Policy based on their review of the electrofishing report mentioned above (item 1). Emphasis for the group focused on providing recommended improvements to Board Manual Section 13 (Guidelines for Determining Fish Use for the Purpose of Typing Waters) without creating the guidance language itself. Their report contained 18 major points—15 points reached concurrence, three did not or are being decided through the PHB analysis. The recommendations receiving general group agreement are outlined below:

Note: Both electrofishing work groups recognized that certain existing elements of Section 13 are appropriate and should remain. The applicable guidance for conducting protocol surveys in Section 13 will be incorporated into Section 23; the Board will then remove Section 13.

(1) <u>Default Physicals</u>

- Ensure the terms used in Board Manual and rule are consistent (e.g., channel width, defined channel, bankfull width).
- Provide guidance on how to establish bankfull average measurement and delineate basin area.

(2) <u>Verifying Fish Presence/Absence above Permanent Natural barriers.</u>

- A protocol survey is required above a permanent natural barrier (PNB) to demonstrate fish presence/absence in determining location of F/N break, if the proponent is not using default physical criteria or some other method.
- If fish are detected above the PNB, caution should be exercised above PNB to avoid potential impacts to small isolated populations.

(4) A temporary natural blockage alone is not a feature that can be used to establish F/N break.

- A temporary natural blockage alone should not be a feature that is used to establish F/N break (e.g. beaver dams, debris steps, wood, etc.).

(6) Habitat disturbances (e.g., debris flow influenced) or Habitat Degradation.

- Proponent should document how their proposed F/N break encompasses the full extent of fish habitat, and how protocol survey data were included in their decision. Consultation with DNR, WDFW, and affected Tribes may be helpful in clarifying necessary information to be used in establishing the F/N break.

(7) Drought

- Keep existing Board Manual language (under Part 2 of Section 13 "Drought Conditions and other Factors Affecting Population Distribution") and add, "proponent to supply rationale on why the proposed F/N break is appropriate given stream flow at time of survey".
- A standalone section [should be] created within the Board Manual dealing with drought.
- Pre-consultation is recommended prior to conducting a protocol survey during a declared drought.

(8) Role of Electrofishing for informing the end of Fish Habitat

- Clarify guidance on how electrofishing informs the F/N break. Electrofishing results provide data specific to species and location of the last fish detected during a single survey. Information on the last detected fish provides a useful starting point to inform the placement of the F/N break.

(9) Using Gradient to End Protocol Surveys

(*Currently being analyzed through the scientific panel for appropriate potential habitat breaks*)

(10) Using Dry Stream Reaches Inappropriately to End Protocol Surveys and establish the F/N break.

- Protocol survey requirements and application of default physical criteria still apply regardless of the presence of flowing water
- The absence of flowing water, alone, should not be used to justify the F/N Break.
- Segments upstream of intermittent flow that meet the default physical criteria should be investigated for isolated fish populations and perched fish habitat

(11) Provide guidance on how to identify F/N break when reach edge of property ownership prior to end of survey, lack of access, etc.

- Provide guidance on how to type waters when proponent reaches edge of property ownership prior to end of survey, lack of access, etc.

(12) What's missing - how to provide guidance on criteria that helps identify habitat that is "likely to be used by fish"

- Require proponent to provide adequate rationale for why the F/N break was established where it was. Provide rationale for why stream segments above the proposed F/N break are not likely to be used by fish at any life stage at any time of the year, including habitat which could be recovered by restoration or management.
- Provide better documentation on what is meant by "recoverable habitat" in -010.

(13) What is the definition of "Defined Channel"?

- Rectify the differences/disconnect between the rule language, Board Manual, and definition (-010). "Defined channel inside the bankfull width, defined channel, bankfull width, etc.

- Provide clarification and guidance on whether "connection" should be used instead of "defined" or "undefined" channel when determining water type.

(14) Survey Timing for Streams

- The current [survey] window as defined by Board Manual 13 (March 1-July 15) is appropriate in most cases for western Washington.

(15) Pre-survey Meetings and Notifications

- Keep existing Board Manual 13 language (last sentence Part 3, "Due to the complexities in anticipating when fish will be seasonally active, survey timing should be determined in consultation with WDFW and affected tribes).
- Provide clarity that the need for pre-survey consultation applies to all proponents and reviewers regardless of stream size.

4. TFW Policy Committee Modifications of DNR/ Services Presented Recommendations, v. 10-25-16

In an attempt to forge a path forward, and utilizing agreed to elements from earlier Policy discussions, DNR and the Federal Caucus presented a straw dog proposal to Policy regarding agreed upon rule concepts and proposed elements needed in guidance. At the November 2016 Board meeting, the Board received Policy's modified version of the DNR and the Services' attempt to formalize negotiations occurring in 2016. The document contains Policy's voted-on recommendations at their October 2016 Water Typing meeting. Guidance elements are provided below.

Board Manual Process

DNR, per WAC 222-12-090, prepares and submits manual sections to the Board for approval. Policy has considered that the manual must include guidance for stream evaluation and the establishment of the Type F/N water type break. Policy wishes to continue to discuss these items and provide consensus recommendations where feasible. Board Manual Section 23 should address the following:

a. Describe elements of Type F waters including field indicators and examples
   - Describe bed/bank for typed waters
   - Natural segments of flowing water
   - Accessibility to habitat at bankfull flow
     o Connectivity to typed water

b. Provide clarification and examples of existing definitions

c. Include sketches, diagram and images
   - How to identify features used to define typed waters

d. Locating the Type F/N Break
   - Fish habitat assessment method

e. Water typing for Type F waters for harvest purposes only
   - Default physical criteria
     o Provide guidance on how to apply them

f. Modeled points
   - How to use model points (in the future)
   - How to place a modeled point on the ground (in the future)

g. Training
   - Training required for reviewers and practitioners for water typing
   - Certification may be helpful

5. Timber, Fish, & Wildlife Policy Committee Summary of Water Typing Discussion for Forest Practices Board, v.10-25-16

This document contains the votes as summarized above in item 4. The recommendations related to Section 23 states that any training for the new water typing system be based on elements contained in Board Manual Section 23.

Motion related to Board Manual guidance at the November 2016 meeting

Motion: … moved the Board accept Policy's consensus recommendations for a permanent Water Typing System and direct staff to prepare draft rule language and prepare Board Manual Section 23, as necessary, in consultation with stakeholders, to be presented to the Board at the May 2017 meeting.

6. TFW Policy Committee Off-Channel Habitat (OCH) Dispute Summary v. 4-24-17

As a result of the findings contained in the Off-Channel Habitat Report dated August 31, 2016, and after completing dispute resolution over off-channel habitat, Policy further deliberated on appropriate definitions of off-channel habitat. The dispute summary outlined their deliberations – the agreed upon *new* and acknowledgement of existing definitions will help formulate guidance. Consensus recommendations are provided below:

- Definition of Type F water remains the same (WAC 222-16-030)
- OCH is connected by surface flow to Type S and Type F waters and is accessible to fish
- In channelized/confined Type F reaches ("streams" under rule definition of bankfull width), the edge of the OCH/start of the RMZ is at bankfull elevation (BFE).
- In non-channelized [Type F] reaches ('periodically inundated areas of associated wetland" under the definition of bankfull width), the edge of the OCH (start of the RMZ) is the OHWL
- OHWL definition remains the same (WAC 222-16-010).
- Board Manual Section 23 guidance should include the field methods for determining OHWL with respect to off channel habitat
- Board Manual Section 23 guidance should include the field methods for determining OHWL with respect to off channel habitat.

7. TFW Policy Proposed Framework for a Statewide Stream Typing Fish Habitat Assessment Methodology (FHAM) to Determine the Type F/N Water Break 4-24-17 v4

The fish habitat assessment methodology will be the tool used for delineating the end of fish habitat. Outlining the framework process was a collaborative approach. The criteria for determining potential habitat barriers limiting fish movement will be incorporated into the assessment when complete. A flowchart will accompany the fish habitat assessment. The framework, without the finalized potential habitat barriers/fish blockage criteria is provided below.

Section 1

Step 1. Pre-Field Office Preparation and Finding the Starting Point on the Ground

- Pre-field preparation is critical for improving the accuracy of the Type F/N water break and protection of fish and their habitat. Office preparation helps focus on the appropriate starting point for field assessment; ensures the field assessment is based on the best available data and information; minimizes the need for electrofishing and survey effort; and maximizes efficiency in the review and approval process.

- The pre-field office method is critical, and should include pre-survey consultation and define documentation standards and expectations.
- As Policy continues to develop recommendations, Policy will discuss pre-survey consultation triggers (e.g., when there is no Water Type Modification Form (WTMF) point); what constitutes pre-survey consultation; and where it should be in rule or guidance.
- Look at DNR hydro layer to determine if the stream has a mapped Type F/N break:
  - If the mapped Type F/N water break point is represented by an approved WTMF, then this point is the regulatory Type F/N water break.
  - If the mapped (modeled) point is not represented by a previously approved WTMF, then this point is the starting point for the field FHAM assessment.
  - If the mapped stream does not have a modeled Type F/N water break or the stream is not mapped, then evaluate all available data starting with the last known fish observation.
- Also consider other datasets: designated Critical Habitat, SalmonScape, local knowledge, etc.

Finding the Starting Point on the Ground

Locate the starting point for the field FHAM assessment for your particular stream:

- If the mapped Type F/N water break point is represented by an approved WTMF, then this point is the regulatory Type F/N water break.
  - Document this point as established and assure the point is permanently recorded, such as permanent field monument and documented GPS coordinates (see Step 3).
  - When fish are observed above the regulatory Type F/N water break or in-field natural occurring channel conditions change, then an on-site Interdisciplinary Team (ID Team) will be assembled and the location of the Type F/N water break will be changed to reflect the findings of the ID Team.
- If the mapped point is not represented by a previously approved WTMF, the habitat assessment will start at the mapped Type F/N water break or the uppermost point at which fish are known to occur.
- If there is no Type F/N water break point on a mapped stream or the stream is unmapped, start the field FHAM assessment at the uppermost point of known fish or previously documented waters known to contain fish populations.

Step 2: Potential Habitat Break (PHB) Assessment and Revised Protocol Survey

1. Beginning at starting point, walk upstream looking for point(s) of significant change meeting the criteria of a potential habitat break (PHB) or permanent natural barrier (PNB). This is accomplished through an ongoing assessment of the primary elements noted in Section 2 for the PHB/PNB.

- Document each PHB or PNB point and assure the point is permanently recorded and documented in the WTMF.

2. Beginning above the PHB or the PNB, apply the revised protocol survey to determine if fish are present.

- If fish are found, continue upstream and repeat the process per **Step 2(A)**.
- If no fish are found, establish the Type F/N break per the process outlined in **Step 3**.
  - Document this point as established and assure the point is permanently recorded.
  - When fish are observed above the water break or in-field natural occurring channel conditions change, then an on-site ID Team will be assembled and the location of the Type F/N water break will be changed to reflect the findings of the ID Team.

Step 3: Establish Type F/N Water Break
When establishing the Type F/N water break through a WTMF, the establishment of the point in the field and in the DNR hydrologic mapping layer is critical for assuring the accuracy of the Type F/N water break and protection of fish and their habitat. These points must be documented in a manner to assure Type F/N water break is honored for all future FPAs. This requires the point to be permanently recorded, including:

- Accurate descriptions in the WTMF; and
- Documented in WTMF and in DNR hydro layer.

Section 2 – Barriers
Potential habitat break (PHB)
Knowing when to stop and when to keep walking is an essential element to accurately and reasonably identify the uppermost extent of fish habitat likely to be used.

Motion related to Board Manual guidance at the May 2017 meeting

Motion: …moved the Board acknowledge that Policy has completed both stages of Dispute Resolution and the Board is assuming management for the development of the final issues needed to have a complete permanent water typing system.
Motion: …moved the Board accept Policy's framework for a Fish Habitat Assessment Methodology (FHAM).
Motion: …moved off-channel habitat (OCH) to include:

- Type F channelized streams: The edge of OCH is bankfull elevation, the outer edge of inundation as defined at the bankfull elevation ("edge" as defined in 4 WAC 222-16-010);
- Type F non-channelized streams: The edge of OCH is the OHWL, which includes those portions of wetlands periodically inundated at the ordinary high 7 water level.

8. Review and Recommendations for Potential Fish Habitat Breaks to Begin Protocol Surveys to Determine end of Fish Habitat on State and Private Forest Lands in Washington State, July 27, 2017

The Board received, but did not accept the recommendations for potential habitat barriers criteria outlined in the Scientific Panels' report.

Motion related to Board Manual guidance at the August 2017 meeting

Motion: …moved the Board direct staff to present all Board approved elements without PHB metrics of a water typing system rule and supporting board manual guidance at the February 2018 meeting.

DEPARTMENT OF
NATURAL RESOURCES

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MEMORANDUM

TO: Forest Practices Board

FROM: Garren Andrews, Compliance Monitoring Program Manager

SUBJECT: Current status of the Compliance Monitoring Program

2017 Compliance Monitoring standard sample field data collection completed December 2017.

2017 Compliance Monitoring Unstable Slopes emphasis sample field data collection completed January 2018.

2017 Compliance Monitoring FPHP pilot study field data collection completed January 2018.

2018 Compliance Monitoring standard sample field work expected to commence March/April.

If you have any questions please contact me at (360) 902-1366 or garren.andrews@dnr.wa.gov

GA/

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
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711 for Washington Relay Service • Persons with a speech disability can call 877-833-6341

Memorandum

January 24, 2018

TO: Forest Practices Board

FROM: Mark Hicks, Ecology Forest Practices Lead
SUBJECT: Clean Water Act Milestone Update

The Washington State Department of Ecology (Ecology) committed to provide the Forest Practices Board (Board) with periodic updates on the progress being made to meet milestones established for retaining the Clean Water Act 303(d) Assurances (Assurances) for the forest practices rules and associated programs. Our last update to the Board occurred at your Nov 2017 Board meeting.

Under Washington state law (Chapter 90.48 RCW and 76.09.040 RCW) forest practices rules are to be developed so as to achieve compliance with the state water quality standards and the federal Clean Water Act (CWA). The Assurances establish that the state's forest practices rules and programs, as updated through a formal adaptive management program (AMP), will be used as the primary mechanism for bringing and maintaining forested watersheds in compliance with the state water quality standards. The Assurances were originally granted in 1999 as part of the Forests and Fish Report (FFR) and spell out the terms and conditions of how Section 303(d) will be applied to lands subject to the FFR. Those original Assurances were to last for only a ten year period. After conducting a review of the program and hearing from stakeholders that they were committed to making the program work, Ecology conditionally extended the assurances for another ten years. This extension was based on the expectation that the program meet a list of process improvements and performance objectives. These are the milestones reported on in this update.

The 2009 milestones were established to create a path of steady improvement in gathering information critical for assessing the effectiveness of the rules in protecting water quality as mandated by state law. Equally important, was the intent to encourage process changes that would lead to cooperators working more productively together to create a more effective research program to test and adjust the rules long-term.

Enclosed are two tables showing the milestones and summarizing their current status. The first table shows the non-CMER project milestones. These milestones are implemented outside of the Cooperative Monitoring, Evaluation, and Research (CMER) program and are largely within the control of the Forest Practices Operations Section of the Department of Natural Resources (DNR) or the Timber Fish and Wildlife Policy Committee (Policy). Changes in status since our last briefing and points of note are highlighted in red font.

Although, progress continues to be made to move numerous milestones forward, no milestones have been completed since the Board's November 2017 meeting.

Please contact me if you have any questions or concerns (360) 407-6477.

Enclosure

Summary of CWA Assurances Milestones and current status:

Non-CMER Project Milestones		
	Summarized Description of Milestone	**Status as of January 2018[1]**
2009	July 2009: CMER budget and work plan will reflect CWA priorities.	**Completed** October 2010
	September 2009: Identify a strategy to secure stable, adequate, long-term funding for the AMP.	**Completed** October 2010
	October 2009: Complete Charter for the Compliance Monitoring Stakeholder Guidance Committee.	**Completed** December 2009
	December 2009: Initiate a process for flagging CMER projects that are having trouble with their design or implementation.	**Completed** November 2010 The product developed that met this milestone is complicated and not being used. The Adaptive Management Program Administrator has stated his intention to refine the process. Any remedy that ensures problems are identified and resolved efficiently would continue to satisfy this milestone.
	December 2009: Compliance Monitoring Program to develop plans and timelines for assessing compliance with rule elements such as water typing, shade, wetlands, haul roads and channel migration zones.	**Completed** March 2010
	December 2009: Evaluate the existing process for resolving field disputes and identify improvements that can be made within existing statutory authorities and review times.	**Completed** November 2010
	December 2009: Complete training sessions on the AMP protocols and standards for CMER, and Policy and offer to provide this training to the Board. Identify and implement changes to improve performance or clarity at the soonest practical time.	**Completed** May 2016
2010	January 2010: Ensure opportunities during regional RMAP annual reviews to obtain input from Ecology, WDFW, and tribes on road work priorities.	**Completed** September 2011

Non-CMER Project Milestones		
	Summarized Description of Milestone	**Status as of January 2018[1]**
	February 2010: Develop a prioritization strategy for water type modification review.	**Completed** March 2013
	March 2010: Establish online guidance that clarifies existing policies and procedures pertaining to water typing.	**Completed** March 2013
	June 2010: Review existing procedures and recommended any improvements needed to effectively track compliance at the individual landowner level.	**Completed** November 2010
	June 2010: Establish a framework for certification and refresher courses for all participants responsible for regulatory or CMP assessments.	**Completed** September 2013
	July 2010: Assess primary issues associated with riparian noncompliance (using the CMP data) and formulate a program of training, guidance, and enforcement believed capable of substantially increasing the compliance rate.	**Completed** August 2012
	July 2010: Ecology in Partnership with DNR and in Consultation with the SFL advisory committee will develop a plan for evaluating the risk posed by SFL roads for the delivery of sediment to waters of the state.	**Underway** DNR, Ecology, and representatives of the small forest landowner caucus are working together to try and develop a solution that will inform the condition of SFL roads. Discussions are leading towards a combination of a self-directed survey with a field validation sample.
	July 2010: Develop a strategy to examine the effectiveness of the Type N rules in protecting water quality at the soonest possible time that includes: a) Rank and fund Type N studies as highest priorities for research, b) Resolve issue with identifying the uppermost point of perennial flow by July 2012, and c) Complete a comprehensive literature review examining effect of buffering headwater streams by September 2012.	**Underway** TFW Policy has reactivated work to complete this milestone. After reaching a tentative agreement on how to handle identification of the Upper Most Point of Perennial Flow during the wet season, Policy agreed to recommend the Board direct DNR to establish a technical work group to resume development of Board Manual 23.
	October 2010: Conduct an initial assessment of trends in compliance and enforcement actions taken at the individual landowner level.	**Completed** November 2010

Non-CMER Project Milestones		
	Summarized Description of Milestone	**Status as of January 2018[1]**
	October 2010: Design a sampling plan to gather baseline information sufficient to reasonably assess the success of alternate plan process.	**Completed** December 2014 DNR satisfied this milestone by releasing an Alternate Plan Guidance memo (12-10-14) designed to strengthen the overall process for issuing alternate plans. Efforts remain pending for DNR to conduct a review to assess whether the guidance is being effectively used.
	December 2010: Initiate process of obtaining an independent review of the Adaptive Management Program.	**Underway** DNR is working with the state auditor's office about performing an audit.
2011	December 2011: Complete an evaluation of the relative success of the water type change review strategy.	**Completed** March 2013 DNR rechecked the current status of the review process used in the regional offices. They found differences in the extent the original processes had been maintained. No assessment was made of whether this affected cooperators ability to contribute to an effective review.
	December 2011: Provide more complete summary information on progress of industrial landowner RMAPs.	**Completed** September 2011
2012	October 2012: Reassess if the procedures being used to track enforcement actions at the individual land owner level provides sufficient information to potentially remove assurances or otherwise take corrective action.	**Completed** June 2012
	Initiate a program to assess compliance with the Unstable Slopes rules.	**Completed** October 2017
2013	November 2013: Prepare a summary report that assesses the progress of SFLs in bringing their roads into compliance with road best management practices, and any general risk to water quality posed by relying on the checklist RMAP process for SFLs.	**Off Track** Described above for July 2010 milestone.

CMER Research Milestones		
Description of Milestone		**Status as of January 2018[1]**
2009	Complete: Hardwood Conversion – Temperature Case Study (Completed as data report)	**Completed** June 2010
	Study Design: Wetland Mitigation Effectiveness	**Completed** October 2010
2010	Study Design: Type N Experimental in Incompetent Lithology	**Completed** August 2011
	Complete: Mass Wasting Prescription-Scale Monitoring	**Completed** June 2012
	Scope: Mass Wasting Landscape-Scale Effectiveness	**Underway**
	Scope: Eastside Type N Effectiveness	**Completed** November 2013
2011	Complete: Solar Radiation/Effective Shade	**Completed** June 2012
	Complete: Bull Trout Overlay Temperature	**Completed** May 2014
	Implement: Type N Experimental in Incompetent Lithology	**On Track**
	Study Design: Mass Wasting Landscape-Scale Effectiveness	**Earlier Stage Underway**
2012	Complete: Buffer Integrity-Shade Effectiveness	**Underway** This study has been delayed since concerns were identified in 2013. Changes in response to the second round of ISPR review comments still need to completed and transmitted back to ISPR for approval.
	Literature Synthesis: Forested Wetlands Literature Synthesis	**Completed** January 2015
	Scoping: Examine the effectiveness of the RILs in representing slopes at risk of mass wasting.	**Completed** April 2017

CMER Research Milestones		
Description of Milestone		**Status as of January 2018[1]**
	Study Design: Eastside Type N Effectiveness	**Underway** ISPR approved study design awaiting CMER concurrence.
2013	Scoping: Forested Wetlands Effectiveness Study	**Completed** December 2016
	Wetlands Program Research Strategy	**Completed** January 2015
	Scope: Road Prescription-Scale Effectiveness Monitoring	**Completed** March 2016
	Study Design: Examine the effectiveness of the RILs in representing slopes at risk of mass wasting.	**Underway** Draft study approved to send to ISPR in January 2018.
	Implement: Eastside Type N Effectiveness	**Earlier Stage Underway** Discussed above for 2012 study design.
2014	Complete: Type N Experimental in Basalt Lithology	**Underway** Findings report drafted but not yet approved by CMER for delivery to Policy.
	Study Design: Road Prescription-Scale Effectiveness Monitoring	**Underway**
	Scope: Type F Experimental Buffer Treatment	**Complete** December 2015
	Implementation: Examine the effectiveness of the RILs in representing slopes at risk of mass wasting	**Earlier Stage Underway** Discussed above for 2013 study design.
	Study Design: Forested Wetlands Effectiveness Study	**Underway** Draft ready for submittal to CMER.
2015	Complete: First Cycle of Extensive Temperature Monitoring	**Underway** Undergoing final post ISPR revision.
	Scope: Watershed Scale Assess. of Cumulative Effects	**Off Track** Project intended to follow other effectiveness monitoring studies which remain behind schedule.

CMER Research Milestones		
Description of Milestone		**Status as of January 2018[1]**
	Scope: Amphibians in Intermittent Streams (Phase III)	**Not Progressing** Project milestone exists only if needed to fill research gaps left from Type Np Experimental in Basalt Lithology. The Type Np Basalt study is expected to be completed in 2018, so Policy established 2019 as a date to begin this study; if questions were not addressed.
2017	Study design: Watershed Scale Assess. of Cumulative Effects	**Off Track** Discussed above for 2016 Scoping.
	Study Design: Amphibians in Intermittent Streams (Phase III)	**Not Progressing** Discussed above for 2015 scoping.
2018	Complete: Roads Sub-basin Effectiveness	**Earlier Stage Underway**
	Implement: Watershed Scale Assess. of Cumulative Effects	**Off Track** Discussed above for 2016 Scoping.
	Complete: Type N Experimental in Incompetent Lithology	**On Track**
2019	Complete: Eastside Type N Effectiveness	**Earlier Stage Underway** Discussed above for 2012 study design.

Status terminology:

"Completed" - milestone has been satisfied (includes those both on schedule and late).

"On Track" - work is occurring that appears likely to satisfy milestone on schedule.

"Underway" - work towards milestone is actively proceeding, but likely off schedule.

"Earlier Stage Underway" – project initiated, but is at an earlier stage (off schedule) then the listed milestone.

"Not Progressing" - no work has begun, or work initiated has effectively stopped.

"Off Track" - 1) No work has begun and inadequate time remains, 2) key stakeholders are not interested in completing the milestone, or 3) attempt at solution was inadequate and no further effort at developing an acceptable solution is planned.

DEPARTMENT OF NATURAL RESOURCES

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January 10, 2018

TO: Forest Practices Board

FROM: Tami Miketa, Manager, Small Forest Landowner Office – Forest Practices

SUBJECT: Small Forest Landowner Office and Advisory Committee

Small Forest Landowner Office Advisory Committee (SFLOAC)
Since my last report, the Small Forest Landowner Office Advisory Committee held meetings on November 28, 2017 and January 9, 2018. Discussions focused on the following topics:

- Review of FPA/N Application and Instruction Forms
- Status of the Capital Budget staff in the SFLO
- Update of SFLOAC Action Plan
- SFLOAC meeting schedule for 2018

Forest Stewardship Program Manager
Long-time DNR Forest Stewardship Program Manager, Steve Gibbs, retired in December after 35 years helping landowners to protect and enhance their forests and achieve their management goals. If you have participated in one of the DNR-WSU Family Forest Owners Field Days in the past three decades, chances are Steve was largely responsible for the "out-in-the-woods educational opportunity" as he describes the wonderful events.

Steve spent his entire career working in landowner assistance, both as a university Extension Forester as well as a Stewardship Forester – or "Service Forester," as they were called back in the day. Steve's focus for helping landowners has been unmatched, as anyone who has worked with him will agree. Punch lines to some, like "the customer is always right" and "money-back guarantee," are tenets to Steve. Steve's caring, generous spirit and actions have made him one of the most valuable resources ever to benefit family forest landowners and those of us who work with them. Steve will be sorely missed throughout the small forest landowner community. I have assumed leadership responsibility for the Forest Stewardship Program in addition to my other managerial duties.

Forestry Riparian Easement Program (FREP), Family Forest Fish Passage Program (FFFPP), and Rivers and Habitat Open Space Program (RHOSP)
As you are aware, the legislature adjourned last year without providing for a Capital Budget, which historically has funded the FREP, FFFPP, and the RHOSP programs. This shortfall has impacted employees of the SFLO. Fortunately, the agency has identified certain positions within

the agency for these valuable staff members to be reassigned until the Capital Budget is finalized and funding is allotted.

Long Term Applications (LTA)
There are now a total of 248 approved long term applications, which is an increase of 3 approved applications since the end of the last reporting period (10/05/2017).

LTA Applications	LTA Phase 1	LTA Phase 2	TOTAL
Under Review	4	1	**5**
Approved	2	247	**249**
TOTAL	**6**	**248**	**254**

Upcoming Landowner Events
5th Forest Owners Winter School –
Colville, WA
Saturday, February 17, 2018

Hands-on Chainsaw Safety and Maintenance Clinic
Colville, WA
Saturday, February 17, 2018

Invasive Weed Control Field Practicum
Bellingham, WA
Saturday, May 5, 2018

Invasive Weed Control Field Practicum
Kent, WA
Saturday, June 2, 2018

Invasive Weed Control Field Practicum
Mount Vernon, WA
Saturday, September 15, 2018

For more information regarding these events go to
http://forestry.wsu.edu/

Forest Stewardship Coached Planning –
WSU's flagship class teaches landowners how to assess their trees, avoid insect and disease problems, attract wildlife, and take practical steps to keep their forest on track to provide enjoyment and even income for years to come. In this class landowners will develop their own Forest Stewardship Plan, which brings state recognition as a Stewardship Forest and eligibility

for cost-share assistance, and may also qualify them for significant property tax reductions. For more information on these courses go to http://forestry.wsu.edu/

The following are scheduled Forest Stewardship Coached Planning courses:

Forest Stewardship Coached Planning – Whidbey Island
Tuesdays starting March 6, 2018

Forest Stewardship Coached Planning – Cle Elum
Mondays starting March 19, 2018

Forest Stewardship Coached Planning – Vashon
Mondays starting March 26, 2018

Washington State University recently hired a Southwest WA Forest Stewardship Educator whose area includes Thurston, Lewis, Pacific, Cowlitz, Mason, Jefferson, Grays Harbor, and Wahkiakum Counties with a focus on the Chehalis River Basin. This is a full-time, 12-month, temporary Administrative Professional position, within WSU Extension Agriculture and Natural Resources Unit (ANR). The position is headquartered at the WSU Lewis County Extension Office in Chehalis, Washington but serving surrounding counties that are a part of the Chehalis River Basin. The main duties of this position will be to conduct outreach activities and facilitate WSU/DNR sponsored coached planning events and Forest Field Days within the Chehalis River Basin.

Please contact me at (360) 902-1415 or tamara.miketa@dnr.wa.gov if you have questions.
TM/

Timber, Fish & Wildlife Policy Committee
Forest Practices Board

PO BOX 47012, Olympia, WA 98504

Policy Co-Chairs:
Scott Swanson, Washington Association of Counties

January 16, 2018

TO: Forest Practices Board

FROM: Scott Swanson, Co-Chair

SUBJECT: Policy Committee Priorities

The Timber, Fish, & Wildlife Policy Committee (Policy) continues to manage a workload near capacity driven by internal process deadlines and priorities directed by the Forest Practices Board. The major topics are summarized below.

Existing Priorities

Permanent Water Typing Rule

Policy continues to monitor the work of the scientific panel, a CMER Technical group, and the AMPA, who will complete the investigation of the final Potential Habitat Break (PHB) language needed to complete the Fish Habitat Assessment Methodology (FHAM).

Policy has recommended to the Board to direct the DNR to begin working on new Board Manual chapter 23 language related to Type N. Caucus representatives are prepared to work with DNR and stakeholders in this effort.

Small Forest Landowners' Alternate Template

Policy subcommittee on SFL Alternate Template has continued to meet and work on possible solutions.

Unstable Slopes Proposal Initiation

Several of the tasks outlined in Policy's recommended actions have been addressed and informed through:

- A literature review for glacial and non-glacial DSLs
- The completion of the Unstable Slopes Criteria TWIG

One other task is still pending:

- UPSAG's Deep-Seated Research Landslide Strategy

Pending further information on the outcomes above, no further action will occur in the interim by the sub-group of policy. The sub-group hopes to meet again within the next few months to complete their work and submit a recommendation to the full policy committee.

CMER

Type N Hard Rock

The Type N Hard Rock study Findings and 6 Questions are being developed and will soon be presented to Policy by CMER.

Westside Type F Extensive Monitoring Pilot

A pilot project using remote sensing tools will help to document riparian conditions along Type F waters around western Washington.

Other CMER reports expected soon:

Bull Trout Overlay Add-On

Fire Salvage Literature Review Findings Report

New Priorities

Policy has formed a subcommittee that has been meeting to discuss criteria necessary to prioritize Policy's future work as it relates to the Master Project Schedule (MPS). These priorities will also help Policy develop future AMP budget recommendations. Policy (with input by CMER) will use these criteria when reviewing the Budget and MPS during their March & April meeting in preparation of a recommendation to the FPB at the May 2018 meeting.

- CWA – Policy is reviewing how the outcome of CWA projects will meet the CWA assurances milestones in the near term
- Unstable Slope – Policy is prepared to reconvene the sub-committee on the Unstable Slope PI when the CMER project is completed
- Forest Health – Policy continues to support the AMPA as he considers possible ideas on improving forest health as it relates to the adaptive management program (and as directed by the FPB)

Budget Review

Policy continues to support the work of the existing budget subgroup as they review the expenses of the AMP, with the AMPA, as an ongoing process throughout the biennium. This subgroup should recommend future action to the full Policy committee in February or March.

Timber, Fish, & Wildlife (TFW) Policy Committee

2017 Accomplishments

v.1-12-18

- Regarding the AMPA's "Unstable Slopes Proposal Initiation Recommendations", Policy:
    - Requested and received feedback from UPSAG, and
    - Formed a Policy subgroup to consider the PI, next steps, and propose recommendations back to Policy.
- Approved Alternative 5 with the additional ability of the Forested Wetlands Effectiveness Project TWIG to include their recommended secondary response variables in the study design.
- Approved funding for Wetland Mapping Tool Project.
- Approved funding for Literature Review and Synthesis Related to the Salvage of Fire-Damaged Timber.
- Approved the Model Development and Evaluation of Default Physical Criteria problem statement, objectives, and critical questions.
- Accepted and took no action on the Glacial Deep-Seated Landslide Literature Synthesis and Findings Report.
- Approved Alternative #3 for the Unstable Slopes Criteria TWIG study design.
- Finalized Water Typing System Policy Recommendations for the May 2017 Board meeting (Type F).
- Consensus agreement to ask the Forest Practices Board to direct DNR to start the process of Board Manual change, as it relates to Type N.
- Accepted the report on the status of Policy's Response to Unstable Slopes Proposal Initiation.
- Received the Type N Hard Rock Study and Non-Glacial Deep-Seated Landslides Literature Synthesis from CMER.
- Approved the CMER FY17/19 biennial budget.
- Held two field tours in:
    - June to see sites in the Spokane region focused on fire salvage and tribal forest management.
    - October to see sites in the Vail region focused on the Uppermost Point of Perennial Flow.

State of Washington
DEPARTMENT OF FISH AND WILDLIFE
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Main Office Location: Natural Resources Building, 1111 Washington Street SE, Olympia, WA

February 13, 2018

MEMORANDUM

To: **Forest Practices Board**

From: **Gary Bell, Wildlife Biologist, Forest Habitats Section**

Subject: **Upland Wildlife Update**

The following provides a brief status update for ongoing or pending actions pertaining to priority wildlife species in forested habitats.

Marbled Murrelet
1992: Federally listed as Threatened
1993: State listed as Threatened
1996: Federal critical habitat designated by USFWS
1997: FPB enacted State Forest Practices Rules
2017: State up-listed to Endangered (Feb 4)

The status of the Marbled Murrelet in Washington has deteriorated since state listing in 1993 (4.4% annual population decline since 2001). Without strategies to address threats to the species it is likely the Marbled Murrelet could become functionally extirpated within the next several decades. WDNR, in consultation with WDFW, recommended that the Forest Practices Board (Board) support WDFW's initiation of a Marbled Murrelet rule assessment involving a diverse group of stakeholders, which will be convened in early 2018. The group will evaluate current rule effectiveness in protecting murrelet habitat, identify weaknesses in rule language and/or on-the-ground implementation, consider potential habitat conservation incentives, and endeavor to bring consensus recommendations to the Board.

Additionally, WDFW continues working with partners to conduct at-sea monitoring surveys and to pursue other critical research regarding sea diet.

Canada Lynx
1993: State listed as Threatened
1994: FPB enacted voluntary management approach
2000: Federally listed as Threatened
2017: State up-listed to Endangered (Feb 4)

The up-listing of the lynx from state threatened to endangered became effective on February 4, 2017. Current information indicates that the distribution of lynx in Washington has contracted significantly from its historical range and the only remaining resident lynx population is in Okanogan County. This population was estimated at approximately 54 individuals in 2016, however this estimate was based on the

amount of habitat that existed prior to the 2017 Diamond Creek fire that occurred within north central Okanogan lynx range. In all likelihood, the current lynx population size is less than previously estimated. Ongoing threats to lynx include loss and fragmentation of habitat, small population size, and the potential effects of climate change. Most habitat changes have been due to large wildfires within the last 13 years. There are no indications that the conservation status of Washington's lynx population has improved since it was state and federally listed.

As a result of the state up-listing, WDFW recommended to WDNR (and subsequently, WDNR to the Board) that no action be taken at this time to add Canada Lynx to the forest practices rule designation for critical habitats (state). It was also recommended that the voluntary protection approach for lynx remain in place, and that WDFW would continue collaboration with landowners to evaluate and refine the effectiveness of lynx habitat management plans (State DNR lands and private industrial lands). WDFW is also working with academic partners, Canadian federal and provincial entities, USFWS, conservation organizations, and tribes, to define recovery actions that can be implemented in the near term to benefit lynx.

On January 11, 2018, the U.S. Fish and Wildlife Service (Service) announced the completion of a scientific review of the Canada lynx in the contiguous United States. The review concluded that the Canada lynx may no longer warrant protection under the Endangered Species Act (ESA) and should be considered for delisting due to recovery. As a result of this status review, the Service will begin development of a proposed rule to delist the species. However, until final rule-making (and any litigation) is completed, the Canada lynx and its designated critical habitat remain protected under the ESA.

Given this announcement, the state-level endangered status, and continued recovery needs in Washington, WDFW will need time to refine its approach to lynx conservation. WDFW will provide more information to DNR and the Board as it becomes available.

Northern Spotted Owl

1988: State listed as Endangered
1990: Federally listed as Threatened
1996: FPB enacted State Forest Practices Rules
2012: USFWS designation of revised critical habitat
2016: State retention of Endangered status

The Washington Fish and Wildlife Commission, at its February 2016 meeting, voted to retain the Northern Spotted Owl as endangered in the state of Washington. The species' population has continued to decline. Causes for the decline include competitive interactions with Barred Owls and habitat loss. The Northern Spotted Owl Implementation Team (NSOIT) has been working to develop a Safe Harbor Agreement (SHA) for forest landowners to provide federal assurances while protecting existing habitat and recruiting new habitat. The group also continues to explore opportunities for landowner incentives.

Fisher

1998: State listed as endangered
2016: Federal status: Final decision for west coast DPS - not warranted for listing (April 2016).

The fisher, a member of the weasel family, continues to be re-introduced to the state after disappearing from Washington's forestlands during the last century. WDFW and partners have successfully translocated a total of 159 fishers from British Columbia to Olympic National Park and federal lands in the southern Cascade Mountains. Most recently, 69 fishers have been released at Mount Rainier National Park and the Gifford Pinchot National Forest since December 2015. Due to the effects of extensive wildfires on fisher habitat in British Columbia in 2017, there will be a delay in subsequent reintroduction efforts until fishers can be obtained from alternative source population

Despite this delay, recovery efforts combined with the Candidate Conservation Agreement with Assurances (CCAA) program administered by WDFW, are assisting the species' return to the state. Non-federal landowners can enroll in the CCAA and receive federal regulatory assurances in the event that the fisher becomes listed under the ESA anytime in the future. By signing on to the CCAA, landowners agree to follow basic conservation measures that protect fishers that may use habitat on their private lands. To date, 46 landowners and 2.9+ million acres of non-federal forest land are enrolled in the CCAA, and additional landowners can enroll at any time.

Future Updates to the Board

The forest practices rules require that when a species is newly listed as state or federally threatened or endangered, or when federal critical habitat is designated, DNR consults with WDFW and makes a recommendation to the Forest Practices Board as to whether Class IV-Special protection is needed under the forest practices critical habitat rule (WAC 222-16-080). Additionally, WDFW and DNR continue to coordinate to anticipate federal actions and/or state action in response to any changes in species status.

cc: Hannah Anderson
Penny Becker
Terra Rentz
Marc Engel
Sherri Felix
Joe Shramek

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January 18, 2018

TO: Forest Practices Board

FROM: Marc Engel
Forest Practices Assistant Division Manager, Policy and Services

SUBJECT: Rule-making activity

Electronic Signature and Payment
This rule will provide the option for applicants to submit electronic Forest Practices Applications and Notifications once the Forest Practices Program launches the new electronic business system. Staff will request your adoption of the rule proposal to file a CR-103 at the February meeting.

Public Records
Legislation passed in 2017 amended the Public Records Act, providing agencies two options for collecting fees during public record requests. The Board chose the fee schedule outlined in statute, resulting in amendments to Chapter 222-08 WAC. Staff will request your adoption of the rule proposal to file a CR-103 at the February meeting.

Permanent Water Typing
In November 2016, the Board directed staff to file a CR-101 Preproposal Statement of Inquiry to notify the public the Board is considering a permanent water typing rule.

In August 2017, the Board directed staff to present all of the Board approved elements, without potential habitat break metrics, for the water typing rule at the February 2018 meeting. Upon receiving additional direction from the Board, staff will prepare draft rule language and all accompanying documents for inclusion with a CR-102 filing to initiate formal rulemaking. It is anticipated this will include new PHB criteria based on the final report from the Science Panel. Stakeholder engagement will occur after the Board directs staff to file the CR-102.

An enclosure is provided briefly outlining the progress for the permanent water typing rule making portion of this memo. I look forward to our February meeting. Should you have questions in the meantime, please contact me at marc.engel@dnr.wa.gov or 360-902-1390

ME

Enclosure (1), *Permanent Water Typing, Overview of activities on rule making for water typing, DNR*

Permanent Water Typing
Overview of recent activities on rule-making for water typing

November 8, 2016, Workshop
The TFW Policy Committee co-chairs and the Adaptive Management Program Administrator (AMPA) provided a synopsis of Policy's deliberation process and decisions made on water typing recommendations. They also presented consensus recommendations for elements to be included in the proposed rule.

November 9, 2016, Regular Board Meeting
At the November 2016 Board meeting, the Forest Practices Assistant Division Manager for Policy and Services described the Policy's recommendations for consideration in the development of a permanent water typing rule.

The Board accepted consensus recommendations and directed staff to file a CR-101 Preproposal Statement of Inquiry to notify the public the Board is considering rule making. In addition, the Board directed staff to prepare draft rule language, which combines accepted elements of WAC 222-16-030 and WAC 222-16-031 to be presented at the May 2017 Board meeting.

May 9, 2017, Special Board Meeting
TFW Policy Committee's Recommendations on water typing system components
The AMPA provided an overview of Board actions pertaining to the permanent rule, including the matrix used by Policy for framing the work, Board direction given at the November 2016 meeting, and the outcomes from the dispute resolution process.

May 10, 2017, Regular Board Meeting
Recommendations for next steps in rule and guidance development for water typing
DNR reminded the Board of the positions resolved through dispute resolution and the items still in dispute. Staff recommendations were presented based on Policy's consensus recommendations for elements of the permanent water typing rule, which include:

- Acceptance of past water-type modification forms as the regulatory Type F/N Water break
- Framework for a Fish Habitat Assessment Methodology
- The AMPA's role in forming a technical expert group to evaluate and describe potential fish barriers.

Actions specific to ongoing work through Policy and Adaptive Management:

The Board passed motions to acknowledge conclusion of the dispute resolution process, acceptance of the Policy's framework for the FHAM, direction to the AMPA to convene a third party technical group in consultation with Policy, and directed the AMPA to bring recommendations on PHBs to the Board at the August 2017 meeting.

Additional actions specific for rule making:

- The Board accepted the recommendation to retain previously approved water type modification points.
- The Board accepted the consensus recommendations regarding definitions of off-channel habitat to use bankfull width for channelized streams, and ordinary high-water line for non-channelized streams, as defined in WAC 222-16-010 respectively.

August 9, 2017, Forest Practices Board Meeting
The Board directed that the approved elements, without PHB metrics, for the water typing rule and Board Manual guidance be presented at the February 2018 meeting.

DEPARTMENT OF
NATURAL RESOURCES

FOREST PRACTICES DIVISION
1111 WASHINGTON ST SE
OLYMPIA, WA 98504

360.902.1400
WWW.DNR.WA.GOV

January 16, 2018

TO: Forest Practices Board

FROM: Patricia Anderson, Rules Coordinator

SUBJECT: Electronic Business System Rule Making

On February 14, 2018, staff will request the Board adopt forest practices rules providing applicants the option to utilize electric formats when submitting Forest Practices Applications to the department. This rule is a placeholder for when the electronic business portal is developed by DNR. Enclosed for your review are the proposed rule changes, Economic Analysis, Draft Concise Explanatory Statement that contains a summary of the rule proposal and one comment letter.

At the August 2017 meeting, the Board directed staff to file the proposed rule language with the Office of the Code Reviser. The language was published in the Washington State Register on October 4, 2017 and was available for public review and comment until January 5.

The Board received one comment on the rule proposal. One hearing was held in the Natural Resources Building in Olympia on January 4, 2018 in which no one provided testimony.

The small forest landowner long-term application analysis requirement under WAC 222-20-016(4) is not required for this rule making. It is required when proposed rule amendments are intended to directly achieve resource protection objectives. This rule incorporates an administrative business process.

Please feel free to contact me with any questions at 360.902.1413, or Marc Ratcliff at 360.902.1414.

See you in February.

PAA/
Attachment: Rule Proposal for Electronic Business System
Economic Analysis
Draft Concise Explanatory Statement
Comment letter

Forest Practices Board
Proposed Rule Amendments
Acceptance of Electronically Submitted FPA/N Rule Making
January 2018

WAC 222-20-030 Delivery of notifications and applications—Receipts—File numbers.

(1) **Notifications and applications** ((~~should~~)) shall be delivered to the department by mail or personal delivery at the appropriate region office, or electronically when the department develops an electronic business system. Notifications and applications actually received at the appropriate region office by other means may be accepted or returned to the applicant.

(2) **Upon delivery of** a complete notification or application the department will provide a written receipt to the landowner, timber owner, and operator.

(3) **Each receipt will** indicate the file number assigned to the notification or application.

WAC 222-20-010 Applications and notifications—Policy.

(1) **No Class II, III or IV forest practices** shall be commenced or continued unless the department has received a notification for Class II forest practices, or approved an application for Class III or IV forest practices pursuant to the act. Where the time limit for the department to act on the application has expired, and none of the conditions in WAC 222-20-020(1) exist, the operation may commence. (NOTE: OTHER LAWS AND RULES AND/OR PERMIT REQUIREMENTS MAY APPLY. SEE CHAPTER 222-50 WAC.)

(2) **The department shall** prescribe the form and contents of notifications and applications. The department shall specify the information required for a notification, and the information required for the department to approve or disapprove an application.

(3) **Except as provided in subsection (4) of this section, applications and notifications** shall be signed by the landowner, the timber owner, and the operator if the operator is known at the time the application is submitted. Electronic signatures may be accepted when the department develops an electronic business system.

(4) In lieu of a landowner's signature, where the timber rights have been transferred by deed to a perpetual owner who is different from the forest landowner, the owner of perpetual timber rights may sign a forest practices application or notification for operations not converting to another use and the statement of intent not to convert for a set period of time. The holder of perpetual timber rights shall serve the signed forest practices application or notification and the signed statement of intent on the forest landowner. The forest practices application shall not be considered complete until the holder of perpetual timber rights has submitted evidence acceptable to the department that such service has occurred.

(5) **Where an application** for a conversion is not signed by the landowner, the department shall not approve the application. Applications and notifications for the development or maintenance of utility rights of way shall not be considered to be conversions.

(6) **Transfer of the** approved application or notification to a new landowner, timber owner or operator requires written notice by the former landowner or timber owner to the department and should include the original application or notification number. This written notice shall be in a form acceptable to the department and shall contain an affirmation signed by the new landowner, timber owner, or operator, as applicable, that he/she agrees to be bound by all conditions on the approved application or notification. In the case of a transfer of an application previously approved without the landowner's signature, the new timber owner or operator must submit a bond securing compliance with the requirements of the forest practices rules as determined necessary by the department. If an application or notification indicates that the landowner or timber owner is also the op-

erator, or an operator signed the application, no notice need be given regarding any change in subcontractors or similar independent contractors working under the supervision of the operator of record.

(7) **The landowner or timber owner must provide notice of hiring or change of operator** to the department within forty-eight hours of the change. The department shall promptly notify the landowner if the operator is subject to a notice of intent to disapprove under WAC 222-46-070. Once notified, the landowner will not permit the operator, who is subject to a notice of intent to disapprove, to conduct the forest practices specified in the application or notification, or any other forest practices until such notice of intent to disapprove is removed by the department.

(8) **Applications and notifications,** if complete, will be considered officially received on the date ((~~and time~~)) shown on any registered or certified mail receipt, or the written receipt given at the ((~~time~~)) date of personal delivery, or ((~~at the time~~)) on the date of receipt by general mail delivery, or on the date of electronic receipt when the department develops an electronic business system. The department will immediately provide a dated receipt to the applicant. Applications or notifications that are not complete, or are inaccurate will not be considered officially received until the applicant furnishes the necessary information to complete the application.

(a) A review statement from the U.S. Forest Service that evaluates compliance of the forest practices with the Columbia River Gorge National Scenic Area Act (CRGNSA) special management area guidelines is necessary information for an application or notification within the CRGNSA special management area. The review statement requirement shall be waived if the applicant can demonstrate the U.S. Forest Service received a complete plan application and failed to act within forty-five days.

(b) A complete environmental checklist (WAC 197-11-315) is necessary information for all Class IV applications.

(c) A local governmental entity clearing and/or grading permit is necessary information for all Class IV applications on lands that will be converted to a use other than commercial timber operations if the local governmental entity has jurisdiction and has an ordinance requiring such permit.

(d) A checklist road maintenance and abandonment plan is necessary information for all small forest landowners' applications or notifications for timber harvest (including salvage), unless exempt under WAC 222-24-0511, or unless the application is a small forest landowner long-term application which requires a roads assessment.

(9) **Where potentially unstable slopes or landforms are in or around the area of an application,** the department may require the landowner to provide additional information in order to classify the application appropriately. If necessary, the department may require additional geologic information prepared by a qualified expert. The department may request that the qualified expert explain the methods the qualified expert used to evaluate the proposed harvest or construction activities with respect to the potentially unstable slopes or landforms. Nothing in this subsection is intended to require a geotechnical report if the geologic information provided is sufficient to appropriately classify the application.

(a) "Qualified expert" is defined in WAC 222-10-030.

(b) "Potentially unstable slopes or landforms" are those listed in WAC 222-16-050 (1)(d)(i)(A) through (E).

(10) **Financial assurances** may be required by the department prior to the approval of any future forest practices application or notification to an operator or landowner under the provisions of WAC 222-46-090.

COST-BENEFIT ANALYSIS
Pursuant to RCW 34.05.328
Forest Practices Board
Acceptance of Electronically Submitted Forest Practices Applications
January 2018

Introduction

The Forest Practices Board (Board) is proposing rule amendments related to adding electronic transactions as an option for prospective applicants submitting forest practices applications and notifications (FPA/N). For DNR to accept and approve an FPA/N, applicants must provide necessary information, sign the FPA/N and pay a specified fee amount.[1] The proposed rule will allow applicants to submit digital signatures and submit payments electronically. Legislative authority for agencies creating a framework for implementing electronic transactions is found in RCW 19.360.010. Washington State's Office of the Chief Information Officer (OCIO) provides information agencies can use for establishing policy or rules governing the use and acceptance of electronic signatures.

The Administrative Procedure Act (chapter 34.05 RCW) requires agencies to make certain determinations before adopting rules. This document is structured to fulfill agency requirements listed in RCW 34.05.328(1)(a) through (e), and small business impact per the Regulatory Fairness Act, chapter 19.85 RCW.

Goal and Need

Before adopting rules, agencies are required to determine that rules are needed to achieve the general goals and specific objectives of the statute the rules implement.[2] In this case, the statute being implemented is RCW 76.09.060(1):

> *The department shall prescribe the form and contents of the notification and application. The forest practices rules shall specify by whom and under what conditions the notification and application shall be signed or otherwise certified as acceptable. …The application or notification shall be delivered in person to the department, sent by first-class mail to the department or electronically filed in a form defined by the department.*

This statute establishes DNR's authority to specify the information needed on an FPA/N and establishes the process by which DNR receives FPA/Ns.

The Board's Preproposal Statement of Inquiry (CR-101) indicates that the proposed rule "…will allow applicants to submit an electronic FPA/N in addition to the current acceptable methods for submittal of an FPA/N through certified mail or hand delivery to a Department of Natural Resources region office." The goal of the proposed rule is to provide an alternative option in addition to existing methods of submitting and paying for an FPA/N. This rule will not prevent landowners from submitting or providing payment for an FPA/N through conventional methods if they do not have access to electronic platforms or desire to use electronic systems.

DNR's Forest Practices Division is in the process of updating the current business application system. The new system, when active, will provide the ability for applicants to submit an FPA/N

[1] Forest practices fees are charged for most forest practices activities, not all activities require fees. RCW 76.09.065.
[2] RCW 34.05.328(1)(b).

through electronic formats, including signatures and fee payment. This rule will precede the new applications system. Providing electronic transactions is a business model practiced within both government and within private sector as a way to lower transaction costs for both customers and organizations alike.

Rule Proposal

The rule proposal amends WAC 222-20-010 and WAC 222-20-030. Minor content addition in subsection (3) in WAC 222-20-010 makes clear that electronic signatures submitted through an electronic system will be accepted once DNR implements the new system and hold the same standing as a hand written signature. Additional content is subsection (8) in WAC 222-20-010 specifies that an electronically submitted applications and payment will be considered received pending review by region staff.[3] Minor content addition in subsection (1) in WAC 222-20-030 clarifies the ability for applicants to submit FPA/Ns through conventional means ***or*** by an electronic system to the appropriate region office.

Alternatives to Rule Making, Consequences of Not Adopting a Rule, and Least Burdensome Alternative

Agencies must analyze alternatives to rule making and the consequences of not adopting a rule[4], and must determine, after considering alternatives, that the rule being adopted is the least burdensome alternative for those required to comply with it.[5] The Board is not considering alternative versions of the proposed rule, but there may be alternative ways to accomplish the Board's goal to, "provide an alternative option in addition to existing methods of submitting an FPA/N." Alternatives that were considered are as follows:

Alternative 1: Adopt the proposed rule.
Alternative 2: Do not adopt the proposed rule.
Alternative 3: Do not adopt the proposed rule but accomplish the goal using another method.
Alternative 4: Adopt the proposed rule <u>and</u> supplement the goal by another method.

- Alternative 1 would accomplish the goal.
- Alternative 2 would not accomplish the goal.
- Alternative 3 could accomplish the goal to some extent, but would require DNR as an agency to adopt a policy that covers all operational divisions of DNR. Communicating that an electronically submitted FPA/N is an acceptable method could be added to the FPA/N instructions.
- Alternative 4 would accomplish the goal to a greater extent than either 1 or 3.

Concerning the consequence of not adopting the rule, DNR and/or the Forest Practice Division would need to establish a policy for accepting electronic formats. Although the OCIO allows agencies to implement this through policy or rule, the Board has elected to accomplish this through rule making. This decision is consistent with the adoption of past rules governing the Board's FPA/N application and notification chapter.

[3] The same process used for receiving FPA/Ns and payment by mail and the subsequent review by region staff to verify completeness will apply to electronically submitted FPA/Ns.
[4] RCW 34.05.328(1)(b).
[5] RCW 34.05.328(1)(e).

Alternative 4 may be the most effective method because it would reach prospective applicants who rely on the rules for their information, and also applicants who rely on the FPA/N instructions for their information. Adopting rule also clarifies the manner in which region offices receive completed FPA/Ns. In addition, a rule would ensure electronic signatures have the same force and effect as that of a signature fixed by hand. Other modes of information such as the Forest Practices Illustrated or tutorial guides would also provide applicants the knowledge regarding electronic processes.

As for a "least burdensome" alternative, none of the listed alternatives would be more burdensome for applicants than DNR's current FPA/N submittal and payment process.

Benefit and Cost of the Rule

Before adopting rules, agencies must determine that the probable benefits of the rule are greater than its probable costs, taking into account both the qualitative and quantitative benefits and costs, and the specific directives of the statute being implemented.[6]

DNR is electing not to quantitatively assess the rule proposal since the costs to implement are accrued by DNR and the benefits are passed on to applicants opting to use electronic transactions. The rule is an expansion of DNR's current business model and does not change, nor impose additional requirements for those wishing to submit FPA/Ns.

Benefit: Providing the ability for applicants to submit signatures and payment electronically is expected to benefit prospective applicants seeking the option to do so. In some cases, the use of electronic records decreases transaction times and reduces costs, such as savings in reduced printed material or travel time associated with delivering FPA/Ns to region offices. It is anticipated that the more applicants use electronic options provided with the new system, the greater an awareness of its efficiency will occur.

Cost: Because DNR already requires the potential applicants to sign an FPA/N and provide fees for conducting certain forest practices activities, landowners will not bear any additional costs from this rule making.

Initial upfront program costs to DNR will occur for the anticipated building of the new electronic business system. Cost estimates are not available because the new system is still in the planning phase. However, incorporating electronic options into the planned system will not affect the decision to move forward by the department.

Small Business Impacts

The Regulatory Fairness Act requires state agencies prepare a small business economic impact statement (SBEIS) for proposed rules if the rules will impose more than minor costs on businesses in an industry.[7] The purpose of the SBEIS is to look at how a rule might impact small businesses. When these impacts are identified, the agency must try to find ways to reduce those impacts.

As previously stated, the rule is not expected to impose additional costs to applicants because it is an expansion of the existing process and does not change DNR's FPA/N requirements or fees. In some cases, utilizing an electronic option may disproportionately benefit smaller businesses by

[6] RCW 34.05.328(1)(d).
[7] RCW 19.85.030.

reduced transit times to region offices. Therefore, the proposed rule does not meet the threshold of imposing more than minor costs on businesses, and an SBEIS is not required.

Summary

Goal of the rule proposal

The Board's goal in adopting the rule proposal is to provide an electronic option when submitting an FPA/N and providing payment for forest practices activities. The proposed rule language supplements the existing language in WAC 222-20-010 and -030 by specifying that DNR will accept electronic signatures and payment once DNR has implemented the new system. The process for receiving and reviewing an FPA/N and payment by region staff will be the same for those submitted by mail or through an electronic format.

Alternatives to rule making and consequence of not adopting a rule

Per Washington State's OCIO guidelines, agencies must establish use of electronic systems by policy or rule. The alternative method to accomplish the Board's goal through DNR policy would not reach the intended audience. Some prospective applicants rely on rules for their information rather than on agency websites or policy links. For that reason, the consequence of not adopting the rule may be that this subset of prospective applicants will not be adequately informed. The most effective way to reach the targeted audience therefore, is to both adopt the proposed rule and add the information to the FPA/N instructions to assure that as many applicants as possible understand their options.

Benefit and cost of the rule proposal

It is expected that adding language to chapter WAC 222-20 regarding electronic signature and payment options will be beneficial for prospective applicants. This rule making does not limit the method DNR will accept an FPA/N and receive payment, nor conversely, require prospective applicants to use only electronic formats. Therefore, individuals will not bear additional costs because DNR's business model will continue to allow prospective applicants to submit FPA/Ns signed by hand and provide payment by conventional means.

STATE OF WASHINGTON **PO Box 47012**
FOREST PRACTICES BOARD **Olympia, WA 98504-7012**

As required by the
Administrative Procedure Act
Chapter 34.05 RCW

DRAFT
CONCISE EXPLANATORY STATEMENT
AND
RESPONSIVENESS SUMMARY
FOR THE ADOPTION OF
Chapter 222-20 WAC, Electronic Business Rule Making

Prepared by: Patricia Anderson
January 2018

1. Introduction

The Forest Practices Board (Board) is amending WACs 222-20-010 and 222-20-030 by adding electronic transactions as an option for prospective applicants when submitting forest practices applications and notifications (FPA/N). The rule will allow applicants to submit digital signatures and submit payments electronically. This rule will not limit the method in which the department will accept an FPA/N and receive payment, nor conversely, require prospective applicants to use only electronic formats. This rule is a placeholder for when an electronic business portal becomes available for DNR to receive FPA/N.

Legislative authority for agencies creating a framework for implementing electronic transactions is found in RCW 19.360.010.

The Board adopted the rule on *February 14, 2017*, and becomes effective 31 days after the rule is filed with the Office of the Code Reviser.

2. Differences between proposed and final rule

The text being adopted is identical to the text as proposed in WSR 17-19-016 filed on September 7, 2017.

3. Summary of Comments

One written comment was received during the public review period from October 4, 2017 through January 5, 2018. No comments on the preliminary Economic Analysis were received.

Comment in Support of the Proposed Rule Language:
The comment from Washington Forest Protection Association (WFPA) was in support of the rule making. However, WFPA questioned whether the proposed language was clear in stating the Board's authority to accept electronic payments and suggested that it be specifically stated in rule that electronic payment is indeed allowed.

Response:
Duly noted. The Forest Practices rules do not detail how payments can be delivered to DNR region offices. Traditionally, the department has maintained the phrase 'Notifications and Applications' equates to the forest practices application/notification form and accompanying fee. The best way to convey an electronic payment is an option for applicants to choose (once the electronic business system is active), is to explain the process in the forest practices application instructions.

4. Rule Making Timeline, Notices, and Opportunities to Participate

2/8/2017	Forest Practices Board approved filing *Preproposal Statement of Inquiry* (form CR-101). There was a public comment opportunity at the meeting prior to the Board action.
4/5/2017	CR-101 published in the Washington State Register (WSR 17-07 filed March 22, 2017).
8/9/2017	Forest Practices Board approved filing *Proposed Rule Making* (form CR-102) and the draft rule language for public review and comment. There was a public comment opportunity at the meeting prior to the Board action.
10/4/2017	CR-102 published in the Washington State Register (WSR 17-19 filed September 7, 2017). Public comment period was from October 4, 2017 through January 5, 2018, including one hearing on January 4, 2018 in Olympia.
10/4/2017	Notice of Rule Making Activity #17-02 distributed via the Board's list of interested parties, GovDelivery notice, and website at https://www.dnr.wa.gov/about/boards-and-councils/forest-practices-board/rules-and-guidelines/forest-practices-board-rule.
12/14/2017	Hearings notice distributed via GovDelivery notice and website at https://www.dnr.wa.gov/about/boards-and-councils/forest-practices-board/rules-and-guidelines/forest-practices-board-rule.
1/4/2018	Public hearing in Olympia.

WASHINGTON FOREST PROTECTION ASSOCIATION
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360-352-1500 Fax: 360-352-4621

January 5, 2018

Patricia Anderson
Washington Forest Practices Board
PO Box 47012; Olympia, WA 98504-7012
Forest.practicesboard@dnr.wa.gov

Submitted Electronically

Re: Electronic Signature and Electronic Payment Rule-Making; WSR 17-19-016

Dear Ms. Anderson:

Washington Forest Protection Association (WFPA) is a forestry trade association representing large and small forest landowners and managers of nearly 4 million acres of productive working, including timberland located in the coastal and inland regions of the state. Our members support rural and urban communities through the sustainable growth and harvest of timber and other forest products for U. S. and international markets. For more information about WFPA, please visit our website at www.wfpa.org. We appreciate the opportunity to comment on WSR 17-19-016, the Forest Practice Board's (Board) proposed rule related to forest practices application electronic signature and electronic payment.

The Board's proposed rule expands the Department of Natural Resources' (Department) ability to accept electronic delivery and receipt of forest practices and notifications. It also allows the acceptance of electronic signatures. The Department is in the process of updating the forest practices application system and these administrative authorities are necessary to administer an enhanced electronic submission of applications and notifications. WFPA supports this new rule language. We do have one question: the authority to accept electronic *signatures*, *delivery* and *receipt* are all specified in the proposed rule. However, electronic *payment* is not. The Board may wish to clarify that electronic payment is indeed allowed by including it in actual rule language. In the future, we anticipate an updated electronic business system is user-friendly and enhances efficiency. WFPA looks forward to continued work with the Board. Please don't hesitate to contact us with questions.

Sincerely,

Karen Terwilleger
Senior Director of Forest and Environmental Policy

DEPARTMENT OF
NATURAL RESOURCES

FOREST PRACTICES DIVISION
1111 WASHINGTON ST SE
OLYMPIA, WA 98504

WWW.DNR.WA.GOV

January 8, 2018

TO: Forest Practices Board

FROM: Marc Ratcliff, Forest Practices Policy Section

SUBJECT: Rule Making: Public Records Request Fees

On February 14, I will request Board adoption of the amended forest practices rules addressing fee structure changes the department will use to produce public records requests.

Legislation in 2017 through House Bill 1595 amended the Public Records Act by allowing agencies two options for collecting fees during a public record request. The Board chose to use the statutory default fee amounts in RCW 42.56.120 because using the actual cost method would not be cost-effective to accomplish. This requires amending the public disclosure rule by implementing the fee structure in the Public Records Act.

At the November 2017 meeting, the Board directed staff to file the proposed rule language, which was published in the Washington State Register in October 2017 and was made available for public review and comment until January 5.

The public hearing occurred on January 4 in the Natural Resources Building in Olympia. No one provided oral testimony at the hearing. Staff received one comment letter acknowledging the Board is following the provisions in HB 1595 and is in support of the proposed rule.

Enclosed for your review are:

- Rule proposal
- Draft Concise Explanatory Statement
- Washington Forest Protection Association's comment letter, dated January 5, 2018

A cost-benefit analysis is not required because the rule is specifically dictated by statute (House Bill 1595 amending RCW 42.56.120).

The small forest landowner long-term application analysis requirement under WAC 222-20-016(4) is not required for this rule making. It is required when proposed rule amendments are intended to directly achieve resource protection objectives. This rule proposal only clarifies the fee structure the Board will use when charging for public records requests.

Please feel free to contact me with any questions at 360.902.1414, or marc.ratcliff@dnr.wa.gov

MR

Attachment: Rule Proposal for Public Records Request Fees
Draft Concise Explanatory Statement
Comment letter, 1/5/2018

FOREST PRACTICES BOARD
Public Records Fee Schedule Rule Making
Proposed Rule
February 2018

WAC 222-08-025 Definitions.

. . .

(5) "Public record" as defined in RCW 42.56.010(~~2~~3), means any writing containing information relating to the conduct of government or the performance of any governmental or proprietary function prepared, owned, used, or retained by any state or local agency regardless of physical form or characteristics.

(6) "Writing" as defined in RCW 42.56.010(~~3~~4), means handwriting, typewriting, printing, photographing, including, but not limited to, letters, words, pictures, sounds, and all papers, maps, magnetic or paper tapes, photographic films and prints, video recordings, diskettes, sound recordings, and other documents including existing data compilations from which information may be obtained or translated.

WAC 222-08-032 Function, organization, and office.

. . .

(6) Staff support is provided to the board as provided in RCW 76.09.030(~~6~~5). Staff shall perform the following duties under the general authority and supervision of the board:

(a) Act as administrative arm of the board;

(b) Act as records officer to the board;

(c) Coordinate the policies and activities of the board; and

(d) Act as liaison between the board and other public agencies and stakeholders.

. . .

WAC 222-08-040 Operations and procedures.

(1) The board holds quarterly scheduled meetings on the second Wednesday of February, May, August, and November, at such times and places as deemed necessary to conduct board business. At regularly scheduled board meetings, agenda time is allotted for public comment on rule proposals and board activities, unless the board has already set public hearings on the rule proposals. Special and emergency meetings may be called anytime by the chair of the board or by a majority of the board members. Notice of special and emergency meetings will be provided in accordance with RCW 42.30.070 and 42.30.080. All meetings are conducted in accordance with chapter 42.30 RCW and RCW 76.09.030(~~4~~3). A schedule of meetings shall be published in the *Washington State Register* in January of each year. Minutes shall be taken at all meetings.

(2) Each member of the board is allowed one vote on any action before the board; pursuant to RCW 42.30.060(2), secret voting is not allowed. All actions shall be decided by majority vote. A majority of the board shall constitute a quorum for making decisions and promulgating rules necessary for the conduct of its powers and duties. When there is a quorum and a vote is taken, a majority vote is based upon the number of members participating. The chair, designee, or majority of the board may hold hearings and receive public comment on specific issues such as rule making that the board will consider in its actions.

(3) Rules marked with an asterisk (*) pertain to water quality and are adopted or amended with agreement from the department of ecology. See WAC 222-12-010.

(4) The chair or majority of board members shall set the meeting agenda. Public requests for topics to be included in the board's quarterly public meeting agenda must include the name of the requester, and be received at the office at least fourteen days before the scheduled meeting. Topics requested may be added to the meeting agenda at the chair's discretion or by a majority vote of the board members. Pursuant to RCW 42.30.077 agendas of each regular meeting will be available online no later than twenty-four hours in advance of the published start time of the meeting.

(5) Written materials for the board which are not provided in advance of the meeting date will not be distributed during the meeting unless fifteen copies are provided to staff.

WAC 222-08-050 Public records--Availability.

The board's public records are available for inspection and copying except as otherwise exempted under RCW 42.56.210 through 42.56.~~480~~470, any other law, and this chapter.

WAC 222-08-090 Disclosure of public records.

Public records may be inspected or copies of such records obtained, upon compliance with the following procedure:

(1) A request shall be made in writing, by fax or electronic mail, to the public records officer or designee. The request shall include the following information:
- (a) The name of the person requesting the record;
- (b) The calendar date of the request; and
- (c) A description of the record(s) requested.

(2) Within five business days of receiving a public records request, as required by RCW 42.56.520, the office shall respond by:
- (a) Providing the record; or
- (b) Acknowledging that the office has received the request and providing a reasonable estimate of time required to respond; or
- (c) Denying the request.

(3) The office may request additional time to provide the records based upon the need to:
- (a) Clarify the intent of the request;
- (b) Locate and assemble the information requested;
- (c) Notify third persons or agencies who may be affected by the request; or
- (d) Determine whether any of the information requested is exempt and that a denial should be made for all or part of the request.

(4) The public records officer may, if it deems the request is unclear, ask the requester to clarify the information the requester is seeking. If the requester fails to clarify the request, the office need not respond to it.

(5) Public records shall be available for inspection in the office from 9:00 a.m. to noon and from 1:00 p.m. to 4:00 p.m., Monday through Friday, excluding legal holidays and during board meetings.

(6) No fee shall be charged for the inspection of public records. ~~For printed, typed and written public records of a maximum size of 8 1/2" by 14", the board shall charge twenty-five cents per page to reimburse the board for the actual costs of providing the copies and the use of copying equipment. Copies of maps, photos, films, recordings, and other nonstandard public records shall be furnished at the board's actual costs. The board shall charge the~~

~~current rate for tax and shipping on all disclosure copying requests~~ The board's charges for producing public records shall follow the fee schedule established in RCW 42.56.120, because calculating the actual costs associated with records production would be unduly burdensome. The public records officer may waive the fees ~~when the expense of processing the payment exceeds the cost of providing the copies~~for de minimus requests. Before releasing the copies, the public records officer may require a deposit not to exceed 10 percent of the estimated cost.

(7) The public records officer may determine that all or a portion of a public record is exempt under the provisions of chapter 42.56 RCW. Pursuant to RCW 42.56.070(1) and 42.56.210(1), the public records officer may ~~delete~~ redact portions of public records. The public records officer will explain the reasons for such ~~deletion~~ redaction in writing, including the exemption that applies.

(8) Any denial of a request for public records shall be in writing, specifying the reason for the denial, including the specific exemption authorizing the nondisclosure of the record, and a brief explanation of how the exemption applies to the records withheld.

(9) Any person who objects to a denial of a request for a public record may request review of such decision by submitting a written request to the public records officer. The written request shall specifically refer to the written statement by the public records officer or designee which constituted or accompanied the denial.

(10) Immediately after receiving a written request for review of a decision denying disclosure of a public record, the public records officer or designee denying the request shall refer it to the chair of the board. The chair shall consider the matter and either affirm or reverse such denial.

(11) Administrative remedies shall not be considered exhausted until the chair of the board or designee has returned the request for review with a decision or until the close of the second business day following receipt of the written request for review of the denial of the public record, whichever occurs first.

STATE OF WASHINGTON
FOREST PRACTICES BOARD

PO Box 47012
Olympia, WA 98504-7012

As required by
the Administrative Procedure Act
Chapter 34.05 RCW

CONCISE EXPLANATORY STATEMENT AND RESPONSIVENESS SUMMARY FOR THE ADOPTION OF Amendments to chapters 222-08 Rules Related to Public Records Request Fees

Prepared by: Marc Ratcliff
January 2018

1. Introduction

The Forest Practices Board's Public Records Request Fee rule amends WAC 222-08-025, -032, -040, -050, and -090. Rule amendments are needed due to 2017 Legislation (House Bill 1595) which amended the Public Records Act. The legislation allowed agencies two options for collecting fees during public records requests. The Board chose the default statutory fee structure in RCW 42.56.120. The statue lists the dollar amount an agency may charge for the various types of record requests.

The purpose of this rule is to provide potential requestors the process and fee structure DNR will use when responding to record requests. Included in this rule making are needed corrections to a few Revised Code of Washing reference numbers.

The Board adopted the rule on _____, and it will become effective on _____.

2. Describe Differences Between Proposed and Final Rule

Proposed rules were published in the Washington State Register in November 2017 for public review and comment. There were no public comments made during the public hearing. One comment letter was received in support of the rule. As a result, no changes will occur to the final rule.

3. Responsiveness Summary

No response will be made to the letter of support.

4. Summary of public involvement actions.

August 9, 2017	Forest Practices Board meeting: The Board approved filing the CR-101, *Preproposal Statement of Inquiry*.
Oct. 4, 2017	CR-101 published in Washington State Register (WSR 17-19-015, filed 9/7/2017).
Nov. 8, 2017	Forest Practices Board meeting: The Board approved filing *Proposed Rule Making* Form CR-102 and the draft rule language for public review and comments. There was a public comment opportunity at the meeting prior to the Board action.
Nov. 22, 2017	CR-102 published in the Washington State Register (WSR 17-23-187, filed 11/20/2017). The public comment period took place from 11/22/2017 through 1/5/2018.
Jan. 4, 2018	Public hearing in Olympia.

WASHINGTON FOREST PROTECTION ASSOCIATION
724 Columbia St NW, Suite 250
Olympia, WA 98501
360-352-1500 Fax: 360-352-4621

January 5, 2018

Patricia Anderson
Washington Forest Practices Board
1111 Washington St SE
PO Box 47012; Olympia, WA 98504-7012
Forest.practicesboard@dnr.wa.gov

Submitted Electronically

Re: Public Records Fee Schedule Rule-Making; WSR 17-23-187

Dear Ms. Anderson:

Washington Forest Protection Association (WFPA) is a forestry trade association representing large and small forest landowners and managers of nearly 4 million acres of productive working, including timberland located in the coastal and inland regions of the state. Our members support rural and urban communities through the sustainable growth and harvest of timber and other forest products for U. S. and international markets. For more information about WFPA, please visit our website at www.wfpa.org. We appreciate the opportunity to comment on WSR 17-23-187-016, the Forest Practice Board's proposed rule related to fees for public record requests.

The Board's proposed rule amends forest practices public disclosure rules to implement provisions of House Bill 1595 (2017) that allows state agencies to charge fees for public disclosure requests. The proposed rule adopts the statutory fee schedule outlined in RCW 42.56.120. WFPA supports the proposed rule which will help the agency defray costs related to public records requests and reduce the diversion of current resources from other critical agency programs. WFPA looks forward to continued work with the Board. Please don't hesitate to contact us with questions.

Sincerely,

Karen Terwilleger
Senior Director of Forest and Environmental Policy

DEPARTMENT OF
NATURAL RESOURCES

FOREST PRACTICES DIVISION
1111 WASHINGTON ST SE
OLYMPIA, WA 98504

360.902.1400
WWW.DNR.WA.GOV

January 10, 2018

TO: Forest Practices Board

FROM: Marc Engel, Assistant Division Manager, Policy and Services

SUBJECT: 2018 Work Plan (proposed changes)

At your November 2017 meeting the Forest Practices Board's 2018 Work Plan was approved, attached. The Work Plan is reviewed and potentially amended by the Board at each regularly scheduled quarterly meeting. At the February 2018 meeting I will request the Board consider adjusting the completion dates for the amending of Board Manual Section 12 (Forest Chemicals) and the development of Part 2 of Board Manual Section 23 (Perennial Stream Identification).

The priority for staff is the development of Part 1 of Board Manual Section 23 (Protocol to locate the Type F/N break) in conjunction with the permanent water typing rule. This work is planned to be completed for the August Board meeting. The work plan currently shows the completion date for Part 2 of Section 23 and Section 12 as November 2018. Staff recommends the Work Plan be amended to show a completion date for Part 2 of Section 23 as either August or November of 2018; and the completion of Section 12 as 2019. This will allow DNR to maintain the stakeholder group for the development of Part 1 and Part 2 of Section 23 before convening a new stakeholder group to review and amend Board Manual Section 12 (Forest Chemicals).

If you have questions regarding these changes, please do not hesitate to contact me at (360) 902-1390 or marc.engel@dnr.wa.gov.

ME
Attachment

FOREST PRACTICES BOARD
2018 WORK PLAN

TASK	COMPLETION DATE/STATUS
Adaptive Management Program	
• Buffer/Shade Effectiveness Study (amphibian response)	May
• CMER Master Project Schedule Review*	May
• CMER Master Project Schedule Compliance Review*	August
• Hardwood Conversion Study	May
• PHB recommendation from science/technical experts	February
• TFW Policy Committee Progress Report on Unstable Slopes Recommendations from the Board approved Proposal Initiation	As needed
• Small Forest Landowner Western Washington Low Impact Template: TFW Policy Recommended Review Process & Timeline*****	November
• TFW Policy subgroup & SFL Report on template alternatives and methodologies	February
• Hard Rock Study	August
Annual Reports	
• WAC 222-08-160 Continuing review of FP rules (Annual Evaluations), *by tradition the Board has received an annual evaluation of the implementation of cultural resources protections*	August
• Clean Water Act Assurances	August
• Compliance Monitoring 2014-2015 Biennial Report (w/ISPR Review)	February
• Compliance Monitoring 2016-2017 Biennial Report	August
• Northern Spotted Owl Conservation Advisory Group	August
• Taylor's Checkerspot Butterfly Report	May
• TFW Policy Committee Priorities*	August
• Western Gray Squirrel	May
Board Manual Development	
• Section 12 Forest Chemicals	*2019*
• Section 23 (Part 1) Field Protocol to Locate Mapped Divisions Between Stream Types*	August
• Section 23 (Part 2) Perennial Stream Identification*	*August /* November
CMER Membership	As needed
Critical Habitat - State/federal species listings and critical habitat designations	As needed
Field Tour	*October*
Forest Health and Wildfire Recommendations for Process & Timing	February
Washington Geologic Survey Presentation	February
Rule Making	
• Water Typing System – CR103	August
• Water Typing System – CR102	May
• Electronic FPA/N, Signature and Payment	February
• Public Records Fee Schedule	February
Subcommittee Recommendations on AMP Improvements	On-going
Cultural Resources Recommendations from Facilitated Process (progress reports)	On-going

Italics = proposed changes
**= TFW Policy Committee*

Updated February 2018

FOREST PRACTICES BOARD
2018 WORK PLAN

TASK	COMPLETION DATE/STATUS
Quarterly Reports	
• Adaptive Management Program*	Each regular meeting
• Board Manual Development	Each regular meeting
• Compliance Monitoring	Each regular meeting
• Clean Water Act Assurances	February
• Legislative Activity	February & May
• NSO Implementation Team	Each regular meeting
• Rule Making Activities	Each regular meeting
• Small Forest Landowner Advisory Committee & Office	Each regular meeting
• TFW Cultural Resources Roundtable	*To be determined*
• TFW Policy Committee Work Plan Accomplishments & Priorities*	Each regular meeting
• Upland Wildlife Working Group	Each regular meeting
Work Planning for 2019	November

Italics = proposed changes *Updated February 2018*
**= TFW Policy Committee*