Appendices for Final Draft Monitoring Strategy

Table of Contents

APPENDIX A: 2002 MONITORING STRATEGY PRIORITIES AND PREVIOUS MONITORING WORK 3

A.1 MONITORING TECHNICAL REPORTS AND PUBLISHED PAPERS, AND THE ASSOCIATED RESPONSES TO THEIR FINDINGS 3
A.2 2002 MONITORING STRATEGY QUESTIONS: PRIORITIES AND STATUS 9

APPENDIX B. ODF PRIVATE FORESTS MONITORING UNIT: MISSION, VISION, AND VALUES 21

APPENDIX C. CHARTER WORK PLAN FOR UPDATING MONITORING STRATEGY 22

APPENDIX D. PROCESS FOR UPDATING THE MONITORING STRATEGY AND ASSOCIATED QUESTION ORGANIZATION 28

D.1 METHODS 28
D.1.1 Phase I: Develop and organize monitoring questions 30
D.1.2 Phase II: Prioritize questions 33
D.1.3 Phase III: Complete the Monitoring Strategy 35
D.2 BIN A. IN-SCOPE IMPLEMENTATION QUESTIONS (MONITORING UNIT LEAD) 36
D.3 BIN A. IN-SCOPE EFFECTIVENESS QUESTIONS (MONITORING UNIT LEAD) 41
D.4 BIN B. IN-SCOPE QUESTIONS (MONITORING UNIT SUPPORT) 50
D.5 BIN C. OUT OF SCOPE QUESTIONS 55

APPENDIX E: INFORMATION SOURCES USED FOR PRIORITIZING MONITORING QUESTIONS 61

E.1 STAKEHOLDER GROUPS INVITED TO PARTICIPATE IN DEVELOPING THIS UPDATE OF THE MONITORING STRATEGY 61
E.2 OREGON DEPARTMENT OF FORESTRY DOCUMENTS ASSESSED 61
E.3 USE OF PARTNER AGENCY DOCUMENTS TO INFORM THE STRATEGY 62

APPENDIX F. LIST OF PRIORITIZED QUESTIONS 63

F.1 PRIORITIES OF IMPLEMENTATION QUESTIONS 63
F.2 PRIORITIES OF EFFECTIVENESS QUESTIONS 68

APPENDIX G. FEEDBACK ON THE STRATEGY 76

List of Figures

Figure D.1 Process for updating Private Forests Monitoring Strategy. Green boxes represent work of Stakeholders, blue represent ODF staff work, and violet is from partner agencies documents 29
Figure D.2. Categories of questions of various types and the role of Private Forest's Monitoring Unit in addressing the questions. 32

List of Tables

Table A.1 Available technical reports and published papers (written by or for ODF), responses to findings, and where to go for more information 3
Table A.2 Monitoring questions and priority rating from the 2002 Monitoring Strategy. 9

Table D.2 In-scope Implementation Questions (Monitoring Unit in lead role) 36
Table D.3 In-scope Effectiveness Questions (Monitoring Unit in lead role) 41
Table D.4 In-scope questions (Monitoring Unit in support role) 50
Table D.5 Out of scope questions 55
Table F.1.1 Priorities of Implementation Questions 63
Table F.2.1 Priorities of Effectiveness Questions 68
Table F.3 Question pairs that are the same or similar on implementation and effectiveness lists 75

Appendix A: 2002 Monitoring Strategy Priorities and previous Monitoring work

A.1 Monitoring technical reports and published papers, and the associated responses to their findings

This section helps to maintain institutional memory of previous responses to monitoring projects (see section 4.B.6 for potential responses), and acts as a placeholder for responses to findings for future projects. Information gathering for responses to some historical projects is ongoing (listed as "TBD" in the table), and are included here as a placeholder.

Table A.1 Available technical reports and published papers (written by or for ODF), responses to findings, and where to go for more information

Name of project or report(s)	Associated Action or Informational Items	For more information
Waters of the State (1991-2)	*TBD*	*TBD*
Riparian Rule Effectiveness Study, March 1993; Water Classification and Protection Project Draft Report (presented to Board of Forestry, April 1992); Report on the Analysis of Proposed Water Classification and Protection Rules (1993)	-Technical information related to 1994 riparian rules; -Riparian Rule Effectiveness Study, March 1993 analyzed in Systematic Review (Czarnomski et al., 2013) developed for 2012-2016 Riparian Rule Analysis (see associated info on report, below)	Lorensen, T., C. Andrus, J. Runyon. 1994. The Oregon Forest Practices Act Water Protection Rules: Scientific and Policy Considerations (see below).
Municipal Water Source Turbidity study (pre-1994, mentioned in Table 1 of 1994 Monitoring Strategy)	*TBD*	*TBD*
Protection of Specified Resource Sites: Northern Spotted Owl, Great Blue Heron, Bald Eagle, Osprey report (pre-1994, mentioned in Table 1 of 1994 Monitoring Strategy)	*TBD*	*TBD*
Pesticide studies ("Forest herbicide application: Water sampling study", 1992; Morman, David. 1993. "Carbaryl Water Sampling Report".	Board changed rules on general pesticide applications (approximately mid-1990s)	
Original landslides studies (3 annual reports of all slides seen by forest practices foresters, estimated late 1980s) -Keith Mills. 1991. Winter 1989-90 landslide investigations	Provided some insight on controlling factors, took to Regional Forest Practice Committees, set stage for study of 1996 landslides (see Technical Report #4); 1995 changes to road and harvesting rules for clarity	*TBD*

Name of project or report(s)	**Associated Action or Informational Items**	**For more information**
Statewide Basin and Reach-level Stream Temp. Monitoring (3 reports listed on p. 18 of 1998 Monitoring Strategy): 1. 1993 Harvest Unit Monitoring; 2. Small Type N Streams and Brush Creek, 1995 [discussed below, Tech. Report #2]; 3. Small and Medium Type F Streams 1997: Effectiveness of HWCs and RMAs [discussed below, Tech. Report #3]	Referenced in "Report of the Forest Practices Advisory Committee on Salmon and Watersheds" (August 2000)	
Dent L. 1995. Influence of small clearcut openings in riparian areas on summer stream temperatures on coastal Oregon and western Cascade streams. COPE Report, Oregon State University/College of Forestry	-analyzed in Systematic Review (Czarnomski et al., 2013) developed for 2012-2016 Riparian Rule Analysis (provided data for Newton and Cole, 2013b of that review) (see associated info on report, below)	
Temperature and streamflow regulation by streamside cover, July 29 1996, M. Newton and M. Zwieniecki. Report for ODF	- analyzed in Systematic Review (Czarnomski et al., 2013) developed for 2012-2016 Riparian Rule Analysis, and other analyses used by the Board in this Analysis (see associated info on report, below)	Published as: Zwieniecki MA, M Newton. 1999. Influence of streamside cover and stream features on temperature trends in forested streams of western Oregon. *Western Journal of Applied Forestry* 14: 106–113.
Technical Report #1. The Oregon Forest Practices Act Water Protection Rules: Scientific and Policy Considerations, December 1994	Describes rationale behind rules and how they were developed; also used as template for scientific background paper for the new (2015) Riparian Rules (i.e., for PCW compliance)	
Technical Report #2. Cooperative Stream Temperature Monitoring: Project Completion Report for 1994 – 1995, September 1999	*TBD*	

Name of project or report(s)	**Associated Action or Informational Items**	**For more information**
Technical Report #3. Effectiveness of Riparian Management Areas and Hardwood Conversions in Maintaining Stream Temperature, March 1997	-Presented to the Board of Forestry in [acquire date]; -analyzed in Systematic Review (Czarnomski et al., 2013) developed for 2012-2016 Riparian Rule Analysis (see associated info on report, below)	
Technical Report #4. Robison, E. George, Keith A. Mills, Jim Paul, Liz Dent, Arne Skaugset. 1999. Storm Impacts and Landslides of 1996: Final Report, June 1999	Changes to public safety rules[1] (first state forestry department with public safety authority); division 623 is entirely new division	-Presented to Board July 23, 1999 as part of Monitoring Unit update -July 2001 LSPS Issue Paper and ODF Recommendations -Rule language approved by Board at October, 2002 meeting, rules effective Jan. 1, 2003
Technical Report #5. Compliance Monitoring Project: 1998 Pilot Study Results, November 1999	Refined study methods and led to full 2002 BMP study (see Technical Report #15)	
Technical Report #6. Compliance With Fish Passage and Peak Flow Requirements at Stream Crossings Pilot Study Results, March 2000	Linkages between written plans and outcome success (for study see Technical Report #14)	-MOU on fish passage with ODFW (proposed to Board May 2000)
Technical Report #7. Aerial Pesticide Application Monitoring Final Report, March 2000	Indicated current rules effective at meeting water quality goals. Presented to Board July 23, 1999 as part of Monitoring Unit update	-See Board July 23, 1999 materials
Technical Report #8. Evaluation of the Effectiveness of Forest Road Best Management Practices to Minimize Stream Sediment Impacts - *Final FY 96 Report to the Oregon Dept. of Environmental Quality*	Part of information included with rule change process for (OAR-625-625 (-0600(9), -0700).	-Board approved new rule language (re: road maintenance) July 19, 2002
Technical Report #9. Forest Roads, Drainage, and Sediment Delivery in the Kilchis River Watershed, June 1997	*TBD*	

[1] Note: These rule changes were also related to SB 1211 (1997) and SB 12 (1999)

Name of project or report(s)	**Associated Action or Informational Items**	**For more information**
Technical Report #10. Forest Road Sediment and Drainage Monitoring Project Report for Private and State Lands in Western Oregon, February 1998	*TBD*	
Technical Report #11. Sufficiency Analysis: A Statewide Evaluation of Forest Practices Act Effectiveness in Protecting Water Quality, October 2002	Origin of RipStream, wet-weather hauling, and Type N (Trask) studies	
Technical Report #12. Harvest Effects on Riparian Function and Structure Under Current Oregon Forest Practice Rules, July 2001	-Outcomes reported to Board; -pre-dated RipStream study; -analyzed in Systematic Review (Czarnomski et al., 2013) developed for 2012-2016 Riparian Rule Analysis (see associated info on report, below)	
Technical Report #13. Shade Conditions Over Forested Streams in the Blue Mountain and Coast Range Georegions of Oregon, August 2001	-Outcomes reported to Board; -pre-dated RipStream study; -analyzed in Systematic Review (Czarnomski et al., 2013) developed for 2012-2016 Riparian Rule Analysis (see associated info on report, below)	
Technical Report #14. Compliance With Fish Passage and Peak Flow Requirements at Stream Crossings: Final Study Results, April 2002	Outcomes reported to Board; origins with 1995 MOU with ODFW	-presented to Board on September 4, 2002
Technical Report #15. Best Management Practices Compliance Monitoring Project: Final Report, April 2002	Outcomes presented to Board; emphasis on education and training	-presented to Board on September 4, 2002
Technical Report #16. Workshop Summary: Headwaters Research Cooperative, October 2001	Informational only	-presented to Board on September 4, 2002
Technical Report #17. Wet Season Road Use Monitoring Project: Final Report, June 2003	Developed road management guide book, road survey protocol for private landowners and reported these to Oregon Watershed Enhancement Board; informed wet-weather hauling rule change	-Board approved new rule language (re: wet season hauling) July 19, 2002 -OSU extension wrote "Managing Woodland Roads: A field handbook"

Name of project or report(s)	**Associated Action or Informational Items**	**For more information**
Technical Report #18. Compliance With Leave Tree and Downed Wood Forest Practices Act Regulations: Results From A Pilot Study, February 2006	Led to full leave tree and downed wood study (see Technical Report #20)	
Technical Report #19. Bald Eagle Monitoring Report, March 2005	This report, combined with formal delisting of Bald Eagles from Endangered Species list, led to rule analysis with a result to rescind roost- and forage-related rules, modify nesting rules	-Report presented to Board April 29, 2005 -Board decision July 27, 2016
Technical Report #20. FPMP Technical Report Compliance with Leave Tree and Downed Wood FPA Regulations Final Report, April 2014	Board directed ODF to explore opportunities to improve the efficiency and effectiveness of administration of ORS 527.676 with the Regional Forest Practice Committees (*on hold as of Fall 2016*)	-Board meeting on April 14, 2014
Dent L., D. Vick, K. Abraham, S. Shoenholtz, and S. Johnson. 2008. Summer temperature patterns in headwater streams of the Oregon Coast Range. *J. Am. Water Resour. Assoc.*, 44, 803 – 813. (RipStream)	Informed subsequent RipStream analyses (Groom et al., 2011a, b)	
Groom, J.D., L. Dent, and L.J. Madsen. 2011. Stream temperature change detection for state and private forests in the Oregon Coast Range. Water Resources Research 47: W01501, doi:10.1029/2009WR009061. (RipStream)	Presented to Board of Forestry, formed the basis for Finding of Degradation and subsequent 2012-2016 Riparian Rule Analysis; analyzed in Systematic Review (Czarnomski et al., 2013) developed for 2012-2016 Riparian Rule Analysis (see associated info on report, below)	-Board finding of degradation: January 4, 2012

Name of project or report(s)	**Associated Action or Informational Items**	**For more information**
Groom, J.D., L. Dent, and L.J. Madsen. 2011. Response of western Oregon stream temperatures to contemporary forest management. Forest Ecology and Management, doi:10.1016/j.foreco.2011.07.012 (RipStream)	Presented to Board of Forestry; analyzed in Systematic Review (Czarnomski et al., 2013) developed for 2012-2016 Riparian Rule Analysis, presented to Board in November 2013 (see associated info on report, below)	Presented to Board, November 11, 2011
Czarnomski, N., C.V. Hale, W.T. Frueh, M. Allen, J. Groom. 2013. Effectiveness of Riparian Buffers at Protecting Stream Temperature and Shade in Pacific Northwest Forests: A Systematic Review. Final Report September 2013.	for 2012-2017 Riparian Rule Analysis, Board: 1. found the report met requirements of ORS 527.714 (5c); 2. directed ODF to explore 3 rule prescriptions (no-cut, variable retention, and Plan for alternate practice); 3. Further explore Geographic Regions to which rule should apply	November 14, 2013 Board meeting
Davis, Lawrence J., Maryanne Reiter, and Jeremiah D. Groom. 2015. Modelling temperature change downstream of forest harvest using Newton's law of cooling. *Hydrological Processes*. (RipStream)	Used to inform upstream extent of 2012-2016 Riparian Rule Analysis, per OAR 340-041-0028 (11a)	-July 23, 2015 Board meeting
Meleason, M, JD Groom, and L Dent. 2013. A Simulation Framework for Evaluating the Effect of Riparian Management Strategies on Wood in Streams: An Example Using Oregon's State Forest Riparian Management Regulations. PNW-GTR-880 (RipStream)	Pilot project for more complete RipStream large wood analysis (to be completed sometime after fall 2016)	

A.2 2002 Monitoring Strategy questions: priorities and status

Table A.2 Monitoring questions and priority rating from the 2002 Monitoring Strategy.

Note: the first 3 columns of these tables are verbatim from the 2002 strategy; the fourth column summarizes the status of work completed in relation to each question.

Number	Riparian Structure and Function Questions	Priority	Summary of status of ODF-associated studies relevant to question
1.	What levels of large wood recruitment are retained in riparian areas of small, medium, and large streams when measured under the current rules? Are the retained levels desirable? (effectiveness)	Top	Ongoing RipStream analysis.
2.	Do the riparian rules promote streamside forest stand structure and large wood recruitment levels that mimic mature riparian stand conditions? (trend, effectiveness, validation)	Top	Ongoing RipStream analysis
3.	Are forest practice rules effectively protecting headwater (small Type N) streams such that local and downstream beneficial uses are protected? Key issues include effects on stream temperature, large wood recruitment, stream flow, sediment delivery, debris torrent processes, macroinvertebrates, and how those effects are translated downstream. (effectiveness, trend, research)	Top	Ongoing Trask and Hinkle analyses; Zegre, 2008; Otis, 2007
4.	Is there a threshold streamflow at which small Type N streams affect the temperature regime of downstream Type F streams (e.g. when they contribute 10% or more of the streamflow)? (validation)	Top	Ongoing Alsea, Trask and Hinkle analyses.
5.	What are the effects (on temperature, flow, and sediment, and large wood regimes) on Type F streams of harvesting multiple contributing small Type N streams? (effectiveness, research)	High	Ongoing Trask and Hinkle analyses; Zegre, 2008; Otis, 2007
6.	What is the effect of slash loading in headwater streams on water quality, fish habitat of downstream Type F streams, and debris torrents? (effectiveness, research)	High	Not started
7.	What percent of landowners and riparian prescriptions implement no-harvest riparian areas in support of the salmon plan? (implementation, OWEB database, OPSW activity 3.8)	High	Robben & Dent (2002) addressed first part of question (percent implementation).

Number	Riparian Structure and Function Questions	Priority	Summary of status of ODF-associated studies relevant to question
8.	What is the implementation rate of active placement of large wood during forest operations? (implementation, OWEB database, OPSW activity 3.5)	Moderate	Ongoing ODF Voluntary Measures project.
9.	Are large wood recruitment incentives (OPSW activity 4.5) providing desired results?	Moderate	Burnett et al., 2008
10.	Are landowners leaving 25% of in-unit leave tree and additional voluntary retention along Type F streams and is this effectively meeting resource protection goals? (OPSW activity 3.6)	Moderate	Not started
11.	Are efforts to place large wood in streams improving fish habitat? (effectiveness)	Low	To be partially addressed by ongoing ODF Voluntary Measures project; Burnett et al., 2008
12.	Are the rules and guidance for the placement of large wood in streams implemented correctly? (implementation)	Low	Not started
13.	What are the compliance rates with the water protection rules? (compliance)	Low	Complete: Clements et al., 2014 plus ongoing monitoring 2013; Robben & Dent, 2002
14.	What are the compliance rates with felling conifers away from small Type N streams? (compliance)	Moderate	Not started
15.	Do the stream improvement activities encouraged under the new water protection rules and the OPSW contribute to salmon recovery? (research)	Top	Not started
16.	What are the implementation rates and effectiveness (maintaining stream temperature, hydrologic, sediment, and wood routing regimes) of limited RMAs on small Type N streams? (implementation, effectiveness, OPSW activity 3.4)	Top	Implementation – Robben & Dent, 2002 Effectiveness – ongoing Trask analysis; Zegre, 2008; Otis, 2007; Kibler et al., 2013
17.	What is the distribution of fish presence throughout the state? (trend, fish presence surveys, OPSW activity 4.7)	High	Ongoing analysis by ODFW
18.	How many miles of stream receive increased protection measures as a result of changing the stream classification from N to F or from N to NT? (trend, OPSW activity 4.8)	High	Not started (Note: No "NT" classification exists under Forest Practices Act)

Number	Riparian Structure and Function Questions	Priority	Summary of status of ODF-associated studies relevant to question
19.	Develop methods for predicting fish presence. (research)	Top	GIS (DEM-based) model developed associated with rule change process to determine first natural barrier to fish use in 2006.
20.	What are the ranges in large wood recruitment, instream large wood, shade and riparian characteristics that occur under "natural" disturbance regimes, under current conditions, and under current forest practice rules? (research, trend)	Top	Dent, 2001; Allen and Dent, 2001 Ongoing RipStream analysis
21.	How do riparian stand, channel and upland characteristics on non-federal forestlands vary by georegion, stream size, forest practice "era"? (trend)	Moderate	Dent, 2001; Allen & Dent (2001) address some of these questions
22.	What are the relationships between trends in riparian condition, instream condition, and salmon populations over time?	Low	Not started
23.	In hardwood-dominated riparian stands, are silvicultural approaches resulting in increased conifer establishment? (effectiveness)	High	Not started
24.	What are the regeneration characteristics (species composition, density, relationships to understory and overstory characteristics) within riparian areas? (effectiveness, trend)	High	Dent, 2001 Ongoing RipStream study
25.	How are the microclimates of riparian areas affected by harvesting under current rules? (research)	Moderate	Not started

Number	Wetlands Questions	Priority	Status
26.	Do the vegetation retention standards for significant and other wetlands protect wildlife habitat and hydrologic functions? (OPSW activity 4.3, effectiveness)	High	Not started
27.	What are the compliance rates for rules designed to protect significant and other wetlands? (implementation)	High	Robben & Dent, 2002 Clements et al., 2014 addressed some rules

Number	Wildlife Habitat/Sensitive Resource Sites Questions	Priority	Status
28.	What are the potential effects of forest practices on bald eagles nesting in Oregon? (effectiveness)	Top	Isaacs et. al, 2005
29.	What are the compliance rates for rules designed to protect threatened and endangered fish and wildlife species that use resource site on forestlands (i.e., northern spotted owl nesting sites, bald eagle nesting sites, bald eagle roosting sites, and bald eagle foraging perches)? (compliance)	Top	Isaacs et. al, 2005
30.	What are the compliance rates for rules designed to protect significant wetlands and other wetlands? (compliance)	Top	Robben & Dent, 2002; Clements et al., 2014 plus ongoing monitoring
31.	What are the compliance rates for rules designed to protect sensitive bird nesting, roosting, and watering sites (i.e., osprey nesting sites, great blue heron nesting sites)? (compliance)	Top	Not started
32.	What are the compliance rates with retention of wildlife trees and downed wood? (compliance)	Top	Weikel et al., 2014
33.	Do the protection measures for northern spotted owl nesting sites ensure that forest practices do not lead to resource site destruction, abandonment, or reduced productivity? (effectiveness)	High	Not started
34.	Do the protection measures for significant wetlands ensure that forest practices do not lead to resource site destruction or reduced productivity? (effectiveness)	High	Not started.
35.	Do the protection measures for osprey ensure that forest practices do not lead to resource site destruction, abandonment, or reduced productivity? (effectiveness)	High	Not started.
36.	Do the protection measures for great blue heron nesting sites ensure that forest practices do not lead to resource site destruction, abandonment, or reduced productivity? (effectiveness)	High	Not started.

Number	Wildlife Habitat/Sensitive Resource Sites Questions	Priority	Status
37.	Describe the species composition and abundance levels of wildlife and plant communities occurring in forest stands of varying seral stages, size classes, and landscape configurations in watersheds managed primarily for timber production. (research)	High	Trask Watershed study will address some wildlife aspects
38.	Develop methods for analyzing wildlife responses to stand- and landscape-level habitat conditions in managed watersheds. (effectiveness, research)	High	Not started
39.	Do the wildlife leave tree and downed wood requirements provide for wildlife habitat as intended?	High	Weikel et al., 2014
40.	What are the implications of preferentially retaining wildlife leave trees along streams in support of the Oregon Salmon Plan?	High	Not started
41.	Do current forest practices protection measures adequately protect headwater amphibian species?	High	Trask Watershed study assessing this; Leuthold et al., 2012
42.	Will current and projected future forest habitat conditions be sufficient to maintain viable populations of forest-dwelling wildlife species in Oregon?	High	Not started
43.	Develop methods to assess and monitor elements of sustainable forestry and biodiversity conservation. (research)	High	Not started
44.	What are the compliance rates for the water protection rules for lakes? (compliance)	Moderate	Robben and Dent, 2002; Clements et al., 2014 plus ongoing monitoring
45.	Do the riparian management area and protection measures for lakes maintain the functions and values of lakes, including those related to water quality, hydrologic functions, aquatic organisms, fish and wildlife? (effectiveness)	Moderate	Not started
46.	Do the protection measures for "other" wetlands, seeps, and springs prevent soil and vegetation disturbances which would cause adverse effects on water quality, hydrologic function, and wildlife and aquatic habitat? (effectiveness)	Low	Robben and Dent, 2002

Number	Stream Temperature Questions	Priority	Status
47.	What are the basin-level trends in stream temperature on a variety of basins? How does harvesting affect basin-level trends in stream temperature? (trend, effectiveness)	High	Ongoing Hinkle, Trask, and Alsea analyses
48.	How do stream temperatures on forested streams vary over time and space? (trend)	High	Ongoing Hinkle, Trask, RipStream, and Alsea analyses Complete: Dent et al., 2008
49.	Are best management practices resulting in temperature increases at the site or watershed levels? (effectiveness)	Top	Ongoing Hinkle, Trask, RipStream, and Alsea analyses; addressed in: Groom et al., 2011a,b; Czarnomski et al., 2013; Dent and Walsh, 1997; Kibler et al., 2013; Zegre, 2008; Otis, 2007; Zwieniecki and Newton, 1999; Newton and Cole, 2013
50.	What are the effects of hardwood conversions on stream temperature? (effectiveness)	Top	Dent and Walsh, 1997; Zwieniecki and Newton, 1999
51.	How do localized increases in stream temperature affect aquatic biota? (research)	Top	Ongoing Hinkle, Trask, and Alsea analyses
52.	Develop effective methods for scaling site-specific temperature impacts from multiple harvest operations to an evaluation of effects at the basin-scale. (research).	Moderate	Ongoing Hinkle, Trask analyses
53.	What levels of shade are retained under the current vegetation retention rules as compared with pre-harvest levels? (effectiveness)	High	Ongoing Hinkle, Trask, RipStream, and Alsea analyses Allen and Dent, 2001; Dent, 2001; Dent and Walsh, 1997; Groom et al., 2011b
54.	How do shade levels vary with stand, channel, valley type, and georegion? (trend)	Moderate	Complete: Allen and Dent, 2001
55.	What are the ranges in stream temperature and shade provided under "historic" disturbance regimes and under current conditions? (trend)	Low	Allen and Dent, 2001; Dent, 2001; Dent and Walsh, 1997; Groom et al., 2011b; Dent, 2008; Zwieniecki and Newton, 1999; Newton and Cole, 2013
56.	What is the role of groundwater input and hyporheic flow in cooling stream reaches? What are the geomorphic characteristics of stream reaches in which subsurface flow contributes to cooling? (research)	High	Trask and Hinkle Watershed

Number	Roads and Slope Stability Questions	Priority	Status
57.	Do crossings installed under current guidance provide juvenile and adult fish passage over time? (effectiveness, research)	Top	Not started
58.	Do crossings installed under current juvenile fish passage guidance have unique maintenance issues? (effectiveness)	High	Not started
59.	What are the compliance rates with juvenile fish passage requirements and guidelines? (compliance)	Moderate	Paul et al., 2002
60.	How do different surfacing and road use practices affect turbidity in streams? (effectiveness, research)	Top	Ongoing Trask analysis
61.	Are best management practices minimizing unacceptable increases in turbidity levels for domestic water systems? (effectiveness)	Moderate	Not started
62.	Are forest practice erosion-related rules, dealing with road construction, maintenance, and harvest activities, preventing and limiting surface erosion and landslides and sediment delivery to waters of the state? (effectiveness)	High	Ongoing Trask analysis
63.	What are the ranges in sediment delivery and routing in stream systems that occur under "historic" disturbance regimes and under current conditions? (trend, research)	Low	Not started
64.	What are the frequency distributions of landslides, debris flows and channel impacts from forested land of various stand ages and management histories? (trend, research, effectiveness)	Low	Robison et. al, 1999
65.	Are high-risk sites consistently identified during the forest practices notification process? (effectiveness)	Moderate	Not started
66.	What are the compliance rates with BMPs for roads, skid trails, and high risk sites? (compliance)	Moderate	Paul et al., 2002, Clements et al., 2014 plus ongoing monitoring
67.	What are the relative contributions of inherent and management-related sediment sources to the sediment budget of a variety of watersheds? (research, effectiveness)	Low	Ongoing Trask analysis

Number	Roads and Slope Stability Questions	Priority	Status
68.	Is the road hazard and risk reduction project being implemented and resulting in improved road conditions? (implementation, OPSW measure #1, OWEB Database)	High	Ongoing ODF Voluntary Measures project
69.	Develop information and analytic tools for evaluating the cumulative effects of forest harvests on stream sedimentation and turbidity. (research)	Low	Mills et al., 2003
70.	What factors affect debris-flow travel potential impacts to homes, roads, and streams? (research)	High (post	Robison et. al, 1999
71.	What is the role of root strength versus canopy alteration of water delivery in slope stability? (research)	Moderate	Not started
72.	Are culverts being designed to pass a 50-year peak flow? (OPSW activity 4.10)	Low	Paul et al., 2002, Clements et al., 2014 plus ongoing monitoring
73.	Are road crossings being installed with no greater than 15-foot fills (OPSW activity 4.11) unless there is prior approval?	High	Clements et al., 2014 plus ongoing monitoring
74.	Are the upgraded stream crossing construction and fill requirements being implemented? (OPSW activity 4.12 OWEB)	High	Paul et. al, 2002; Ongoing ODF Voluntary Measures project

Number	Pesticides Questions	Priority	Status
75.	What level of contamination is injurious (including acute toxicity, chronic toxicity, and sub-lethal behavioral effects) to aquatic biota? (research)	Top	Not started
76.	Is water quality, including the integrity of aquatic communities and public health, being effectively protected when herbicides or insecticides are applied near streams? (effectiveness, research, OPSW activity)	Low	Ongoing Alsea Watershed study Water quality: Oregon Department of Forestry 1992; Oregon Department of Forestry 1993; Dent and Robben 2000

Number	Pesticides Questions	Priority	Status
77.	Is water quality, including the integrity of aquatic communities and public health, being effectively protected when forest management chemicals are applied near small Type N streams? What are the downstream effects on water quality, aquatic biota, and human health if contamination does occur on small Type N streams?	Moderate	Ongoing Alsea Watershed study
78.	What concentrations of chemicals are found in streams when runoff events occur after the initial forest application near streams? Do these concentrations threaten water quality, aquatic biota, or public health, either locally or downstream? (effectiveness, research)	Moderate	Ongoing Alsea Watershed study
79.	Is water quality protected from surfactants, carriers, and "inert" ingredients when chemical applications take place near streams? (research)	Moderate	Not started

Number	Air Quality Questions	Priority	Status
80.	Has smoke from prescribed burning in regulated forest operations met the requirements of the clean air standards? (compliance)	High	Not started

Number	Productivity and Reforestation Questions	Priority	
81.	What is the level of compliance with reforestation rules? (compliance)	High	Oregon Department of Forestry, 1997; Oregon Department of Forestry, 1995; Oregon Department of
82.	Are the reforestation rules resulting in productive forests with characteristic growth and stocking potentials for the site and species? (effectiveness)	Low	Dent, 2001
83.	Are BMPs minimizing soil disturbance and compaction and maintaining long-term forest site productivity? (validation, effectiveness)	Moderate	Not started
84.	What are the compliance rates with rules that are designed to maintain soil productivity? (compliance)	Moderate	Not started

Number	Oregon Plan Questions	Priority	Status
85.	Are volunteer OPSW activities being implemented and are they effective at achieving the salmon protection and restoration goals? The multiple resources imbedded in this question are addressed through specific questions above. (OPSW activity 1.1)	Top	Ongoing ODF Voluntary Measures project.

Number	Additional FPAC Recommendations Questions	Priority	Status
86.	What is the extent of environmental protection, economic, landscape impacts of the proposed NT designation that came out of FPAC?	Top	NA – NT designation not incorporated into Forest Practices Act.
87.	What are the predictors of perenniality and fish presence and how does that affect the NT designation?	High	NA – NT designation not incorporated into Forest Practices Act.
88.	Are Stewardship Plans effective and being implemented in accordance with the agreements?	Moderate	Not started
89.	Can the FPMP aid in monitoring associated with certification programs?	Moderate	Not started

References

Note: The Alsea, Hinkle, and Trask paired watershed studies have multiple theses and publications completed, and presentations given at conferences, in addition to ongoing analyses. Publications and presentations can be found at: http://watershedsresearch.org/results/ .

Allen, M., L. Dent. 2001. Shade Conditions Over Forested Streams In the Blue Mountain and Coast Range Georegions of Oregon. ODF Forest Practices Monitoring Program Technical Report #13.

Burnett, Kelly M., Guillermo R. Giannico, and Jeff Behan. 2008. *A Pilot Test of Systematic Review Techniques: Evaluating Whether Wood Placements in Streams of the Pacific Northwest Affect Salmonid Abundance, Growth, Survival or Habitat Complexity*. Report prepared by Institute for Natural Resources for Oregon Department of Forestry/State Forests.

Clements, P., J. Groom, J. Hawksworth. 2014. Oregon Department of Forestry Forest Practices Compliance Audit 2013.

Czarnomski, N., C.V. Hale, W.T. Frueh, M. Allen, J. Groom. 2013. Effectiveness of Riparian Buffers at Protecting Stream Temperature and Shade in Pacific Northwest Forests: A Systematic Review. Final Report September 2013.

Dent, L. and Robben, J. 2000. Oregon Department of Forestry: Aerial Pesticide Application Monitoring Final Report. 21 pp plus appendices.

Dent, L. 2001. Harvest Effects on Riparian Function Under Current Oregon Forest Practice Rules. ODF Forest Practices Monitoring Program Technical Report #12.

Dent, L., D. Vick, K. Abraham, S. Shoenholtz, S. Johnson. 2008. Summer temperature patterns in headwater streams of the Oregon Coast Range. *Journal of the American Water Resources Association* 44: 803-813.

Dent L., J.B.S. Walsh. 1997. Effectiveness of riparian management areas and hardwood conversions in maintaining stream temperature. ODF Forest Practices Technical Report 3.

Groom, J.D., L. Dent, and L.J. Madsen. 2011a. Stream temperature change detection for state and private forests in the Oregon Coast Range. *Water Resources Research* 47: W01501, doi:10.1029/2009WR009061.

Groom, J.D., L. Dent, and L.J. Madsen. 2011b. Response of western Oregon stream temperatures to contemporary forest management. *Forest Ecology and Management*, doi:10.1016/j.foreco.2011.07.012

Isaacs, F., R.G. Anthony, R.W. Krahmer, B.D. Callahan, J.P. Peck. 2005. Effects of Forest Management Practices on Bald Eagles Nesting on State and Private Land in Oregon. ODF Forest Practices Monitoring Technical Report #19.

Jenkins, S. R. 2010. Post-breeding habitat selection by songbirds in the headwaters of the Trask River, northwestern Oregon. Master's thesis, Oregon State University.

Kibler, KM., A. Skaugset, L.M. Ganio, M.M. Huso. 2013. Effect of contemporary forest harvesting practices on headwater stream temperatures: Initial response of the Hinkle Creek catchment, Pacific Northwest, USA. *Forest Ecology and Management* 310:680–Leuthold, N., M.J. Adams, J.P. Hayes. 2012. Short-Term Response of Dicamptodon tenebrosus Larvae to Timber Management in Southwestern Oregon. The Journal of Wildlife Management 9999:1–10;

2011; DOI: 10.1002/jwmg.269

Li, J.L., S.L. Johnson, J.B. Sobota. 2011. Three responses to small changes in stream temperature by autumn-emerging aquatic insects. *Journal of the North American Benthological Society*, 30(2):474-484. 2011; DOI: 10.1899/10-024.1

Meininger, W. S. 2011. The Influence of Contemporary Forest Management on Stream Nutrient Concentrations in an Industrialized Forest in the Oregon Cascades. Master's Thesis, Oregon State University.

Mills, K., L. Dent, and J. Robben. 2003. Wet Season Road Use Monitoring Project Final Report. ODF Forest Practices Monitoring Program Technical Report #17.

Newton, M, L. Cole. 2013. "Stream Temperature and Streamside Cover 14-17 Years after Clearcutting along Small Forested Streams, Western Oregon." *Western Journal of Applied Forestry* 28(3) 107-115.

Oregon Department of Forestry, 1987. Free-to-Grow: A survey of private forest lands in western Oregon harvested and reforested between 1972 and 1979. 4pp.

Oregon Department of Forestry, 1992. Forest Herbicide Application Water Sampling Study. 40pp.

Oregon Department of Forestry, 1993. Carbaryl Water Sampling Report. 9pp plus appendices.

Oregon Department of Forestry, 1995. Reforestation Accomplishment Report.

Oregon Department of Forestry, 1996. Reforestation Accomplishment Report.

Otis, T. L. 2007. Processes That Influence the Downstream Propagation of Heat in Streams from Clearcut Harvest Units: Hinkle Creek Paired Watershed Study. Master's thesis, Oregon State University

Paul, J., L. Dent, M. Allen. 2002. Compliance With Fish Passage and Peak Flow Requirements at Stream Crossings Final Study Results. ODF Forest Practices Monitoring Program Technical Report #14.

Robben, J., L. Dent. 2002. Best Management Practices Compliance Monitoring Project: Final Report. ODF Forest Practices Monitoring Program Technical Report #15.

Robison, G.E., K.A. Mills, J. Paul, L. Dent, A. Skaugset. 1999. Storm Impacts and Landslides of 1996: Final Report. ODF Forest Practices Monitoring Program Forest Practices Technical Report #4.

Weikel, J., R. Krahmer, J. Cathcart. 2014. Compliance with Leave Tree and Downed Wood Forest Practices Act Regulations. ODF Forest Practices Monitoring Program Technical Report #20.

Zégre, N. P. 2008. Local and Downstream Effects of Contemporary Forest Harvesting on Streamflow and Sediment Yield. PhD dissertation, Oregon State University.

Zwieniecki, MA, M. Newton. 1999. Influence of streamside cover and stream features on temperature trends in forested streams of western Oregon. *Western Journal of Applied Forestry* 14: 106–113.

Appendix B. ODF Private Forests Monitoring Unit: Mission, Vision, and Values

Mission

To inform forest management decision-making with results from high-quality, applied scientific monitoring and research.

Vision

Effective and efficient forest practices, based on sound science, that maintain working forests and protect natural resources.

Consistent production of monitoring study results that are

- High-quality
- Innovative
- Scientifically based
- Relevant & applicable
- Widely available and utilized

A dedicated staff who are regarded internally and externally as leaders in their fields and who consider ODF Private Forests Monitoring to be an employer of choice

Collaborative technical expert and stakeholder involvement that results in transparent, well planned, and well executed projects.

Values

- Objectivity, honesty, integrity, collaboration, learning, and improvement
- Accurate monitoring and scientific information
- Maintaining health of natural resources
- Informed policy and operational decision making
- Research and monitoring performed at the highest professional level

Appendix C. Charter Work Plan for Updating Monitoring Strategy

JANUARY 2015

REQUESTOR	SPONSOR(S)	PROJECT MANAGER	START DATE	END DATE
Oregon Department of Forestry	Lena Tucker	Terry Frueh	January 2015	January 2016

BACKGROUND

The Monitoring Unit of ODF's Private Forests Division conducts monitoring to assess the effectiveness and implementation of rules promulgated under the Forest Practices Act (FPA) to protect natural resources, and other related programs (e.g., Oregon Plan Voluntary Measures). Historically, the Monitoring Unit's agenda has been directed by a strategic plan. The strategic plan provides a description of the Unit's monitoring approach and articulates a list of prioritized monitoring questions. The strategic plan is vital to the Monitoring Unit's mission because it addresses monitoring questions in a methodical and rational process with understanding, acceptance, and support by stakeholders and decision-makers. Results of monitoring efforts are taken to the Oregon Board of Forestry (Board) as part of its adaptive management approach to forest practices rules. Monitoring results also help guide training efforts, administration of the FPA, and delivery of other related programs. The goals of this strategic plan are to:

- Provide the Board, legislature, and other stakeholders timely, pertinent, and sound information at multiple temporal and spatial scales regarding the effectiveness, implementation and assumptions associated with forest practices rules and best management practices, and outcomes on the ground;
- Coordinate with other monitoring and research efforts to ensure efficient use of state resources and contribute to enterprise, integrated monitoring at the state level;
- Determine if rules, regulations or other programs are being implemented in accordance with expectations and whether they are effective in meeting resource protection goals;
- Address highest priority FPA monitoring questions for the Private Forests Division;
- Work collaboratively with technical experts and stakeholders to produce high quality, transparent monitoring results; and
- Provide technical advice and support to other natural resource agencies engaged in baseline monitoring efforts (e.g., forest and stream conditions).

The Department developed the current strategic plan in 2002 (ODF, 2002). Since 2002, the Monitoring Unit has addressed many of the plan's priority questions and the Board has completed a new strategic plan, the Forestry Program for Oregon. During discussion on their water quality topic, the Board has discussed interest in future monitoring projects and priorities. The Department is updating the strategic plan to ensure the strategy reflects current needs and priorities.

PROBLEM STATEMENT

An updated strategic plan is needed to guide project prioritization for an effective and efficient monitoring program.

PROJECT DESCRIPTION

This project will develop the Unit's strategic plan that prioritizes monitoring projects. We will complete this plan by including stakeholders in its development, and by ensuring plan alignment with the Board and Department's priorities and those of other agencies. In addition, we will develop methods to periodically evaluate this plan and update as appropriate. Finally, similarities, differences, and cross-linkages between implementation and effectiveness monitoring will be clarified.

OBJECTIVES & SUCCESS CRITERIA

Objectives	Success Criteria	How Measured
High quality, well-prioritized list of monitoring questions.	-Creative development of potential priorities in alignment with State, Board and Department's priorities and those of other agencies. -Rigorous and transparent process for prioritizing them.	-Test questions for alignment with plans and strategies from State, Board, Department and other agencies -Clearly-explained, rigorous, and rational process for prioritizing questions

	-Identify, and fill in, gaps in monitoring questions.	
Inclusive and transparent process for developing the plan.	-Understanding, acceptance, and support from stakeholders. -Documentation of all decisions and input to develop the plan.	-Support by stakeholders when final strategy brought to Board. -Clearly-defined process to include external and internal stakeholders in monitoring projects. -All decisions and input are clearly documented.
OBJECTIVES & SUCCESS CRITERIA (CONT.)		
Plan integrated with enterprise monitoring efforts.	Clear links established between monitoring strategy and enterprise monitoring efforts	Monitoring priorities cross-linked with enterprise monitoring
Ensure the plan is up to date and we are addressing the correct priorities.	Rational, documentable method to revisit the plan.	Clearly defined process to defend staff time/priorities, while allowing a logical and methodical process for both periodically evaluating and updating the strategy.
Spatial component to prioritization scheme.	Question priorities are geographic-specific.	Each question will indicate priority level for each geographic locale.

PROJECT SCOPE	
In Scope (Will be Included)	**Out of Scope (Will not be Included)**
• Compliance monitoring • Implementation monitoring • Effectiveness monitoring • Assumptions monitoring	• Baseline monitoring • Social monitoring • Forest Health • How to implement the plan

ASSUMPTIONS & CONSTRAINTS	
Assumptions (Key Bets)	**Constraints (Limiting Factors)**
Board and Department are committed to effectiveness and implementation monitoring, and using monitoring results as part of adaptive management and guiding where to focus training.	• ODF must stay within key Division functions.

STAKEHOLDERS - PRELIMINARY	
Interested Parties	**Why Interested**
Landowners: Committee for Family Forestlands, Oregon Forest Industries Council, Oregon Small Woodlands Association, Regional Forest Practices Committees	Affected by findings, partners in monitoring projects
Conservation Community: Oregon Stream Protection Coalition	Environmental concerns
Internal: Field Staff, State Forests	-Play a role in monitoring design & implementation -May have to implement findings
Certification: American Tree Farm System, Forest Stewardship Council, Sustainable Forestry Initiative	-Implementation monitoring supports their efforts

STAKEHOLDERS – PRELIMINARY (CONT.)	
Operators: Associated Oregon Loggers	- Affected by findings
Oregon Forest Resources Institute	- Outreach & education on findings
Tribes of Oregon	- Use findings
Federal Agencies: USDA Forest Service, Natural Resource Conservation Service, Bureau of Land Management, U.S. Geological Survey, National Oceanic and Atmospheric Administration, US Environmental Protection Agency, U.S. Fish and Wildlife Service	-Partners in some monitoring -Use findings
OSU: Forestry Extension, College of Forestry	-Partners in some effectiveness monitoring
State agencies: Department of Environmental Quality, Department of Geology and Mineral Industries, Department of Fish and Wildlife, State Parks and Recreation Department, Columbia River Gorge Commission, Department of State Lands, Oregon Health Authority, Water Resources Department, Department of Agriculture, Oregon Watershed Enhancement Board	-Partners in some monitoring -Board of Forestry required to consult with other agencies (ORS 527.710 (4))
National Council for Air and Stream Improvement.	Partners in some monitoring

RELATED PROJECTS
-Forestry Program for Oregon -ODF key performance measures

-10 Year Plan for Oregon Project, Healthy Environment Policy Vision

-Integrated enterprise monitoring

-Key plans and strategies from other agencies

PRIORITY ASSESSMENT					
Level of Importance:	**Scope**	**Time**	**Cost**	**Quality**	**Risk**
Highest	**X**			**X**	
Medium		**X**			
Lowest			**X**		**X**

PROJECT TEAM		
Resource Name	**Role**	**Responsibilities**
W. Terry Frueh	Project Manager	Project planning & management, communications & outreach
Marganne Allen	Project Oversight	Support Project Manager, communications & outreach as needed
Groom, Olson, Hawksworth, Thompson, Abraham, Clements	Project Support	Provide technical support & review of process
Nick Henneman	Public Affairs	Support Project Manager through press releases and other public outreach

PLAN – TO BE DEVELOPED		
Task	**Date Due**	**Milestone / Deliverable**
See Timeline		
Notes/Comments on Plan:		

COMMUNICATION PLAN - GENERAL					
Deliverable/ Description	**Target Audience(s)**	**Delivery Method**	**Delivery Frequency**	**Who Responsible?**	**Purpose**
Project Charter Plan	Leadership Team, BOF	Hard Copy	Once	Terry Frueh	Information
Team Meetings	Team Members	As Needed	As Needed	Terry Frueh	Info./Input
Sponsor Meetings	Lena Tucker/Peter Daugherty	In person	Throughout project	Terry Frueh	Input
Project Updates	Advisory committee(s), stakeholders	In person, hard copy, email, etc.	As Needed	Terry Frueh	Info./Input
Stakeholder brainstorming of priorities	Internal and External stakeholders	meeting	Once/group	Frueh, Allen, Project support	Input, develop UAS

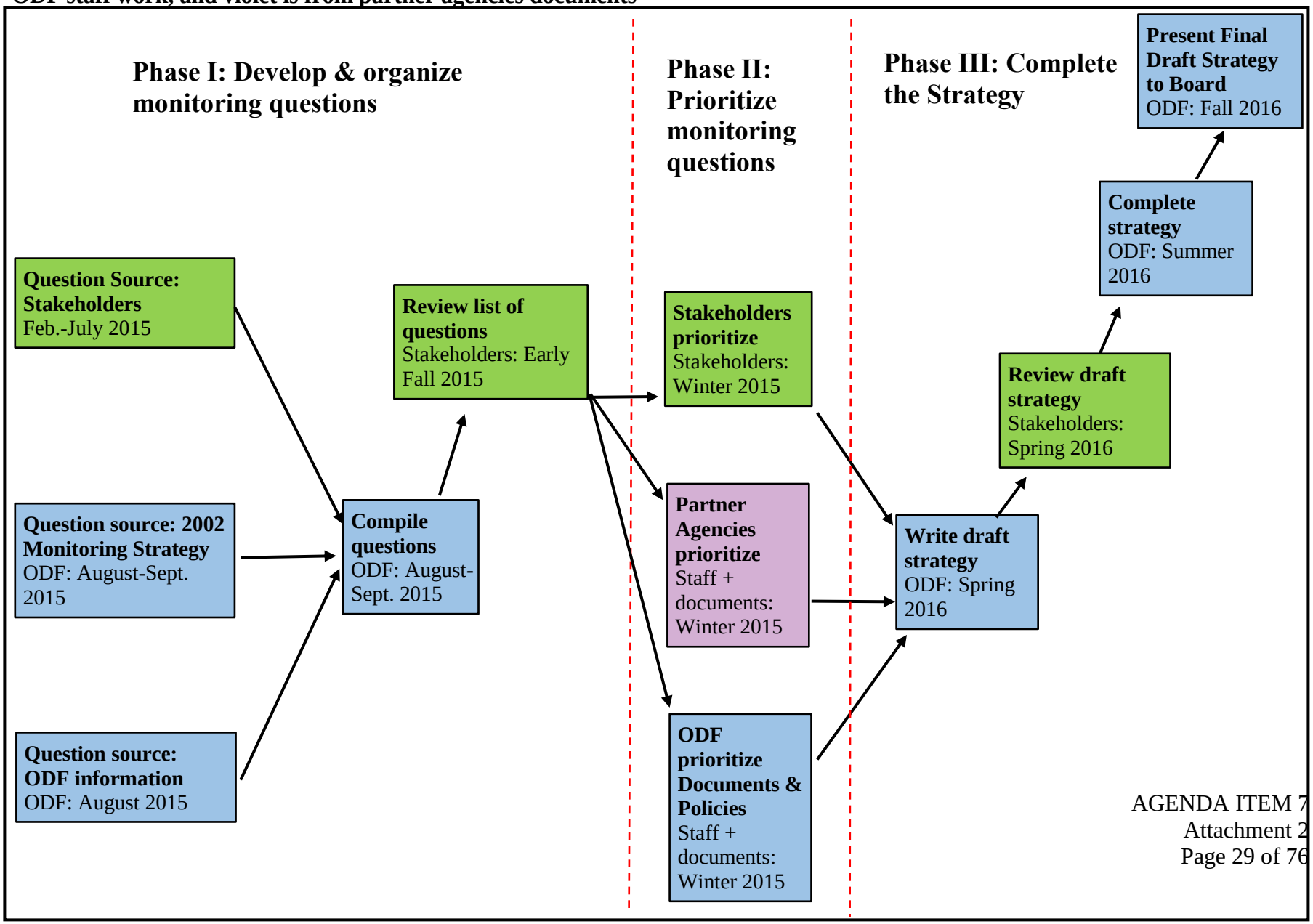
GROUP DECISION MAKING PROCESS
Project Manager (Frueh) will make day-to-day decisions with input from support staff. Problem/ question resolution, Board/committee preparation in coordination with Marganne Allen. Problem/question on Board/committee preparation with Lena Tucker and Peter Daugherty.

Appendix D. Process for updating the Monitoring Strategy and associated question organization

D.1 Methods

To implement this charter, we designed a structured process to follow (Figure D.1; see subsequent sub-sections for more information). In the first phase of the project, monitoring questions were developed, based on three sources of information: Stakeholder input (from individuals, tribes, and staff from other agencies and ODF), the 2002 Monitoring Strategy, and ODF internal discussions. In the second phase, these questions were divided into easier to comprehend groups based on the type of question, and monitoring question types were clearly defined. These re-organized questions were then sent to Stakeholders (including individuals, interest groups, state and federal agencies, and ODF staff) for them to determine their highest priority questions for us to address. Their input was analyzed to determine prioritize questions for this Strategy. The third phase of this update began with writing this Strategy, then sending it to Stakeholders for their input. After addressing Stakeholder input, this final draft strategy is delivered to the Board.

Figure D.1 Process for updating Private Forests Monitoring Strategy. Green boxes represent work of Stakeholders, blue represent ODF staff work, and violet is from partner agencies documents



D.1.1 Phase I: Develop and organize monitoring questions

Monitoring questions to consider in this Strategy came from three sources: the 2002 Strategy, ODF discussions, and stakeholders (includes individuals, and staff from ODF and partner agencies; Appendix section E.1 lists stakeholders invited to participate in this study). We chose to continue using questions from the 2002 Strategy, even if they had been addressed, since there may be aspects of them that warrant addressing, or re-doing in a different part of Oregon. Internal discussions focused on what we saw as issues that needed to be addressed or that were likely to rise in importance.

At the beginning of the process, we met with stakeholders to help them understand how we are updating the Strategy. We also provided them with questions from the 2002 Monitoring Strategy (ODF, 2002) that were placed in a table that included the larger theme under which it applies (e.g., roads and slope stability), the type of monitoring question, the priority in 2002, and the status of ODF-related projects that address at least part of the questions (Appendix A.2). This information was provided to stakeholders to help them understand what questions were considered and which ones were at least partially addressed via ODF-related studies, and to spur their thinking to develop questions for consideration in the latest version of the Strategy.

We also clarified that these questions are not ready for study implementation, and thus would need to be refined. We decided to keep the questions as currently phrased since we wanted to respect stakeholders' input, and there might be important aspects of a question to address that could be lost in refining the questions at this stage. Additionally, the process of refining a question to be addressed via a study requires a significant amount of time, and is out of scope for this Strategy (see section 4.B.2 for information regarding refining questions).

When we saw the long list of monitoring questions, we realized it would be hard for people to consider in an effective manner. We thus re-organized the questions to help stakeholders understand the nature of the questions, and clarified definitions of question types (note: a question may be of more than one type). While the definitions of these types are generally agreed upon (i.e., monitoring professionals outside of ODF would tend to concur with the definitions), these definitions are intended to be used only within the context of this Monitoring Strategy. This intention is due to some of the definitions being specific to Private Forests Division policies and procedures.

Many of the questions were not the type on which we work, and thus we did not want them prioritized. We therefore categorized the questions to clarify which ones are in scope for the Unit's work, as well as the Unit's role for in-scope questions (either as project lead or as support; see subsections D.1.1 and D.1.2 for relationships between categories and question types). Note that previous versions of the Monitoring Strategy did not distinguish between in and out of scope questions. These categorizations also clarify how questions are addressed in this Strategy. Note that questions in a category may be of multiple types, including types found in a different category. Thus, questions are placed in a category based on their question type with the highest degree of involvement from ODF (i.e., lead role is greater than support role is greater than out of scope). Additionally, while we have separated the questions into these categories, these distinctions are not always as clear as we present them to be. We sent these re-organized questions to stakeholders to determine if we missed any questions, or if any of them needed re-phrasing.

D.1.1.a Organize monitoring questions: Definitions of question types
The definitions of monitoring questions for this Monitoring Strategy are:

Effectiveness Monitoring is the process of evaluating whether voluntary measures and legal obligations (i.e., FPA and other requirements), when implemented as intended, achieve the desired goals for resource protection. An example of an effectiveness question is: *Are the water protection measures effective at preventing increases in stream temperatures that otherwise might occur from forest management activities?*

Voluntary Implementation Monitoring is the process of evaluating whether voluntary measures, such as those in support of the Oregon Plan for Salmon and Watersheds (OPSW), were implemented as intended. An example of an implementation monitoring question is: *What is the voluntary implementation rate of active placement of large wood during forest operations?*

Compliance Monitoring is another form of implementation monitoring and evaluates whether legal obligations (i.e., FPA and other requirements) were implemented as intended. An example of a compliance monitoring question is: *Was streamside vegetation maintained in accordance with the water protection rules?*

Trend Monitoring, in the context of this Monitoring Strategy, is the process of evaluating patterns over time and space to determine the range of conditions across the landscape and how such conditions change in response to management, restoration, and the OPSW measures. An example of a trend monitoring question is: *What are the post-harvest riparian conditions in the Coast Range and how do those vary over time?*

Validation Monitoring is the process of evaluating whether the original assumptions used to build the Forest Practices Act rules, other legal obligations, or OPSW voluntary measures were correct or valid. An example of a validation monitoring question is: *Will the desired future condition of riparian area be met under the forest practices riparian management strategies?* Because validation monitoring requires addressing complex cause-and-effect questions, these issues will usually be pursued through research and other studies.

Other Questions do not fall in the aforementioned monitoring types, and include questions that are e.g., basic research, forest health monitoring, or social monitoring.

D.1.1.b Organize monitoring questions: Categorization of monitoring questions by type
We categorized the questions into three bins as follows (Figure D.2):

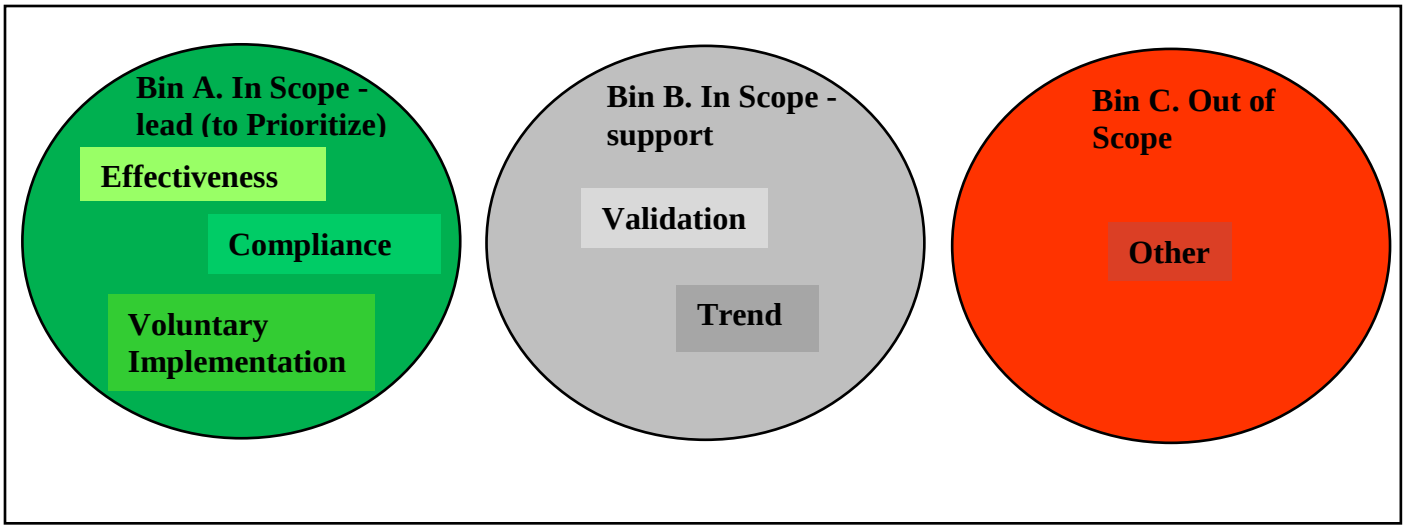


Figure D.2. Categories of questions of various types and the role of Private Forest's Monitoring Unit in addressing the questions.

- **A. In Scope Questions – Monitoring Unit lead (to Prioritize):** These questions (including Effectiveness, Compliance, and Voluntary Implementation types – see definitions above in section D.1.1.a) directly relate to Forest Practices Act (FPA) statues and rules, other Private Forest Division legal authorities or mandates, and/or the OPSW. These are the questions on which the Monitoring Unit focuses our time and energy, we therefore play a lead role in conducting studies. Because of this focus, only questions in this bin are prioritized.
- **B. In Scope Questions – Monitoring Unit support:** These questions (including Trend and Validation types) are important to ODF/Private Forests Division since they inform the Division's efforts and associated implementation of the FPA and other forest practices. However, these are not questions on which we focus our work, and we therefore only play a supportive role in addressing the questions. This role would be partnering opportunistically, either via cash (e.g., as we have done with the Watersheds Research Cooperative), or via in-kind contributions (e.g., data analysis). Since we address these questions as opportunities arise, the questions are not prioritized, yet are listed in Appendix section D.4 for reference.
- **C. Out of Scope Questions:** These questions ("Other Questions") do not directly relate to OPSW, the FPA, or other Private Forests Division legal obligations, and thus are out of scope for us to either do the study or collaborate on an opportunistic basis. As such, they will not be further included in the Monitoring Strategy, other than documented that we considered them and found that they are out of scope for our work (see Appendix section D.5).

After re-organizing the questions, we sent them to Stakeholders to ensure we did not miss any questions, or see if any questions needed re-framing. This document included the definitions of question types, and into which bin they were placed (Appendix sections D.2 and D.3). To provide additional information to stakeholders, each question had the following information: its monitoring type(s) defined in subsection D.1.1.a, status of ODF-related projects, and its general

theme.

D.1.1.c Implementation and effectiveness questions: cross-*linkages*

Implementation and effectiveness questions lead to different types of studies. The former questions lead to assessments of what people do on the ground, the understanding of which may be, in some instances, most informed by experience of field staff rather than published studies. In contrast, effectiveness questions aim to elucidate the effects of implementation on resource protection, and the hypotheses that inform these questions are more based on previous scientific studies. However, these questions are linked within the framework of this Strategy since both aspects affect resource protection.

These questions complement one-another in understanding the impacts of on the ground practices because to achieve the goals of practices, they must both be implemented correctly, and we need to know this implementation is effective. Additionally, they are both in the purview of the Monitoring Unit's work, and thus we think about them often and from multiple perspectives. For example, there is no point in studying the effectiveness of a practice that no one implements (e.g., a condition that does not exist frequently on the landscape, or voluntary measures that are not implemented). Also, if compliance with a practice is low due to e.g., they are costly to implement, then perhaps we need more info on the effectiveness of this practice to see how important it is to implement. Conversely, perhaps many people are implementing measures that may not be effective and thus not worth the investment of resources by landowners or taxpayers (e.g., via cost share programs, or ODF program administration).

D.1.2 Phase II: Prioritize questions

After we addressed Stakeholders' final input on the phrasing of the questions, we divided the questions into a list each for implementation (including voluntary implementation and compliance questions) and effectiveness questions (Appendix sections D.2 and D.3, respectively). Then, we sent these lists to stakeholders, and requested they provide to us their top five and next five priorities for each list. We also sent a list of compliance-only questions (i.e., excluding voluntary implementation and effectiveness questions) to members of the Compliance Audit Review Teams (both internal and external).

We also examined planning documents from both ODF and partner agencies to help prioritize questions. Key ODF documents (Appendix section E.2) were used to determine whether questions were a high, low, or non-existent priority. We also reviewed documents from other agencies to assess prioritizations (Appendix section E.3). Due to the volume of documents (>40) and in part because alignment with questions is less clearly delineated than for ODF documents, this prioritization was only done at the theme level (e.g., water quality, pesticides), rather than the individual question level. However, we decided to determine question prioritizations based only on input from staff (for both ODF and other agencies), and thus we did not use results of these assessments of agencies' documents to prioritize individual questions.

Final prioritizations for each set of questions (i.e., implementation and effectiveness questions) are based on input from stakeholder groups. The top 10 questions for each question set was listed for each of the following groups:

A. Oregon Forest and Industries Council (OFIC)

B. Oregon Stream Protection Coalition (OSPC)

C. Individual contributors

D. ODF staff[2]

E. State and federal agency staff (excluding ODF)

F. Tribes[3]

G. the Compliance Audit External Review Team (CAERT)[4]

Groups A, B, and F submitted a single list of their top questions. The top 10 list for the other groups was based on a summarization of top 10 lists based on individual members' submission. This latter determination was calculated in the following manner:

1. The top 5 questions for each person were given a score of 1 for each question; the second give questions were given a fractional score. This fractional score is based on the average ranking of those questions as a function of total number of questions in that list, normalized against the average ranking of the top five questions, as follows:
    - For implementation questions (n=38), the average ranking of the top 5 was 35.5/38 (given a score of 1), and that of the second 5 was 30.5/38, thus the score of the second five relative to the top 5was (30.5/38)/(35.5/38) which, when rounded to nearest tenth, is 0.9.
    - For effectiveness questions (n=58), the average ranking of the top 5 was 55.5/58 (given a score of 1), and that of the second 5 was 50.5/58, thus the score of the second five relative to the top 5 was (50.5/58)/(55.5/58) which, when rounded to nearest tenth, is 0.9.
2. For each question, all the scores were added for all the members in each group, and divided by the total number of members in the respective group, to get a composite score for that question
3. These composite scores were ranked to identify what questions were in the top 10 for that group

These top 10 lists were considered the questions on which each group voted. For each question, the number of groups voting for it were tallied. Question priorities are based on:

- High priority questions have at least half the groups voting for that questions (i.e., 3 groups voting for an effectiveness question, 4 groups voting for an implementation question);
- Medium priority questions have more than 1 group but less than half the groups voting for the question (i.e., 2 groups voting for an effectiveness question, 2 or 3 groups voting for an implementation question);
- Low priority questions have 1 group voting for a question
- Remove question from list: no groups voting for a question

See Appendix F for detailed results of how these groups voted for all the questions.

While we originally intended to include a geographic component to the prioritizations, we did

[2] The only response received from any members of the Compliance Audit Internal Review Team (CAIRT) was included with those of the rest of ODF staff for implementation questions

[3] Only the Coquille Tribe submitted preferences

[4] This group only voted on compliance questions (which comprise 34 of the 38 implementation questions), not voluntary implementation or effectiveness questions.

not develop a straightforward way to do it, thus we decided to exclude that component from this Strategy.

D.1.3 Phase III: Complete the Monitoring Strategy

We wrote this narrative of the Monitoring Strategy update using the 2002 Strategy as the template that we modified as necessary. After completing internal review of this draft update, it was sent to Stakeholders for their input. We received this input and addressed their comments in this final draft Strategy.

D.2 Bin A. In-scope Implementation Questions (Monitoring Unit Lead)

Table D.2 In-scope Implementation Questions (Monitoring Unit in lead role)

No.	Theme	Question Types	Questions	Summary of status of ODF-associated studies relevant to question
I1	**Riparian Structure and Function Questions**	Effectiveness, Compliance, Trend, Validation	What fraction of riparian areas in forest operation areas are currently on track to meet FPA riparian "desired future condition" targets? For the fraction that is not on this track, what are the causes (e.g., due to legacy, blow-down, lack of hardwood-to-conifer conversion, insufficient FPA compliance)? Do DFC targets translate into mature forest conditions that meet water quality standards and other goals?	Ongoing RipStream analysis
I2		Compliance	What are the compliance rates with felling conifers away from small Type N streams?	Not started
I3		Effectiveness, Voluntary Implementation	Are large wood recruitment incentives (OPSW activity 4.5) providing desired results?	Burnett et al., 2008
I4		Compliance	Are the rules and guidance for the placement of large wood in streams implemented correctly?	Not started
I5		Effectiveness, Voluntary Implementation	Is the current voluntary program for placement of large wood structures in streams active enough to adequately address the need for large wood in streams?	ODF project initiated in 2015; Burnett et al., 2008
I6		Voluntary Implementation	What is the implementation rate of no-harvest riparian areas in support of the Oregon Plan for Salmon and Watersheds (OPSW) or for other reasons? Where are these areas (geographically and by landownership type) and how much in excess of minimum requirements are the retained buffers?	Robben & Dent (2002) addressed first part of question; as of March 2015: project design phase to revisit it

No.	Theme	Question Types	Questions	Summary of status of ODF-associated studies relevant to question
I7		Voluntary Implementation	What is the implementation rate of active placement of large wood during forest operations?	ODF project initiated in 2015
I8		Effectiveness, Voluntary Implementation	Are landowners leaving 25% of in-unit leave tree and additional voluntary retention along Type F streams and is this effectively meeting resource protection goals? (OPSW 3.6)	Not started
I9		Compliance	What are the compliance rates with the water protection rules?	addressed in: Clements et al., 2014 plus ongoing monitoring 2013; Robben & Dent, 2002
I10		Effectiveness, Voluntary Implementation	Are riparian buffer requirements preventing or minimizing stream sedimentation and/or meeting water quality standards and TMDL load allocations in Type F streams?	Ongoing Trask analysis; Zegre, 2008; Zwieniecki and Newton, 1999
I11		Compliance, Effectiveness	What are the implementation rates and effectiveness (maintaining stream temperature, hydrologic, sediment, and wood routing regimes) of limited RMAs on small Type N streams?	Implementation – Robben & Dent, 2002 Effectiveness – ongoing Trask analysis; Zegre, 2008; Otis, 2007; Kibler et al., 2013
I12	**Wetlands and Other Waters**	Compliance	What are the compliance rates for rules designed to protect significant and other wetlands?	Addressed in Robben & Dent, 2002; Clements et al., 2014
I13		Compliance	What are the compliance rates for the water protection rules for lakes?	addressed in: Robben and Dent, 2002;

No.	Theme	Question Types	Questions	Summary of status of ODF-associated studies relevant to question
				Clements et al., 2014 plus ongoing monitoring
I14	**Wildlife Habitat**	Compliance	Are wildlife tree retention rules implemented as intended?	partially addressed in Weikel et al., 2014
I15		Compliance	What are the compliance rates with retention of wildlife trees and downed wood?	addressed in: Weikel et al., 2014
I16		Compliance	What are the compliance rates for rules designed to protect threatened and endangered fish and wildlife species that use resource sites on forestlands (i.e., northern spotted owl nesting sites, bald eagle nesting sites, bald eagle roosting sites, and bald eagle foraging perches)?	Addressed in: Isaacs et. al, 2005
I17		Compliance	What are the compliance rates for rules designed to protect sensitive bird nesting, roosting, and endangered fish and wildlife species that use resource sites on forestlands (i.e., northern spotted owl nesting sites, bald eagle nesting sites, bald eagle roosting sites, and bald eagle foraging perches)?	Addressed in: Isaacs et. al, 2005
I18		Compliance	What are the compliance rates for rules designed to protect sensitive bird nesting, roosting, and watering sites (i.e., osprey nesting sites, great blue heron nesting sites)?	Not started
I19	**Roads and slope stability**	Compliance	What are the compliance rates with juvenile fish passage requirements and guidelines?	addressed in: Paul et al., 2002
I20		Compliance, Effectiveness	Are road waste disposal requirements protecting water quality and human health, and preventing road failure?	Not started
I21		Compliance	What are the compliance rates with BMPs for roads, skid trails, and high risk sites?	addressed in: Paul et al., 2002, Clements et al., 2014 plus ongoing

No.	Theme	Question Types	Questions	Summary of status of ODF-associated studies relevant to question
				monitoring
I22		Compliance, Other	What fraction of culverts in forest operation areas currently meet FPA standards? For the fraction that does not meet standards, what are the causes (e.g., legacy, recent storms, insufficient FPA compliance)?	not started
I23		Compliance, Voluntary Implementation	Are culverts being designed to pass a 50-year peak flow? (OPSW activity 4.10)	addressed in: Paul et al., 2002, Clements et al., 2014 plus ongoing monitoring
I24		Compliance, Voluntary Implementation	Are road crossings being installed with no greater than 15-foot fills (OPSW activity 4.11) unless there is prior approval?	Clements et al., 2014 plus ongoing monitoring
I25		Compliance	Are the upgraded stream crossing construction and fill requirements being implemented? (OPSW activity 4.12 OWEB)	Addressed in: Paul et. al, 2002
I26		Voluntary Implementation	How often are leave trees clumped along debris flow-prone areas?	not started
I27		Compliance, Effectiveness	Are human life and property adequately protected by High landslide hazard location rules?	not started
I28		Compliance	Are high-risk sites consistently identified during the forest practices notification process?	Not started
I29	**Pesticides**	Compliance	Are pesticide rules being followed?	not started
I30	**Productivity and Reforestation**	Compliance	Does compliance with reforestation requirements vary with site preparation methods?	not started
I31		Compliance	What is the level of compliance with reforestation rules?	addressed in Robben

No.	Theme	Question Types	Questions	Summary of status of ODF-associated studies relevant to question
				and Dent, 2002
I32		Compliance	What are the compliance rates with rules that are designed to maintain soil productivity?	Not started
I33	**Other**	Compliance	Are we getting accurate assessments of compliance with rules by private non-industrial owners?	Not started
I34		Voluntary Implementation	Are we getting accurate assessments of voluntary implementation from private non-industrial owners?	Not started
I35		Effectiveness, Voluntary Implementation	Are volunteer OPSW activities being implemented and are they effective at achieving the salmon protection and restoration goals? The multiple resources imbedded in this question are addressed through specific questions above.	Study slated to start in 2015
I36		Effectiveness, Compliance, Validation	Are Stewardship Plans effective and being implemented in accordance with the agreements?	Not started
I37		Compliance, Validation	Are streams consistently typed using the applicable physical criteria? What is the percentage of instances the applicable physical criteria accurately describe the full extent of the stream network that is likely to be used by fish at any life stage for some portion of the year?	Not started
I38		Effectiveness, Compliance, Voluntary Implementation	How can ODF better help protect cultural resources, given that ODF doesn't regulate cultural resources? How can ODF better ensure landowners are complying with State Cultural Resource Law given that ODF is not regulating these resources?	Not started

D.3 Bin A. In-scope Effectiveness Questions (Monitoring Unit Lead)

Table D.3 In-scope Effectiveness Questions (Monitoring Unit in lead role)

No.	Theme	Question Types	Questions	Summary of status of ODF-associated studies relevant to question
E1	**Riparian Structure and Function Questions**	Effectiveness	When implemented, how effective are (new) riparian prescriptions (voluntary or regulatory) at protecting water quality, providing large wood recruitment and attaining desired future conditions?	Ongoing RipStream analyses; Groom et al., 2011a and b; Allen and Dent, 2001; Dent, 2001; Dent and Walsh, 1997; Czarnomski et al., 2013; Newton and Cole, 2013; Zwieniecki and Newton, 1999
E2		Effectiveness, Trend, Validation	Do the riparian rules promote streamside forest stand structure and large wood recruitment levels that mimic mature riparian stand conditions?	Ongoing RipStream analysis
E3		Effectiveness, Trend	Do current riparian management rules and voluntary implementation supply large wood to higher order streams (including non-wadeable streams and estuary habitats) at rates sufficient to maintain or restore habitat complexity? If not, how long will this process take?	Partially addressed in ongoing RipStream analysis

No.	Theme	Question Types	Questions	Summary of status of ODF-associated studies relevant to question
E4		Effectiveness, Compliance, Trend, Validation	What fraction of riparian areas in forest operation areas are currently on track to meet FPA riparian "desired future condition" targets? For the fraction that is not on this track, what are the causes (e.g., due to legacy, blow-down, lack of hardwood-to-conifer conversion, insufficient FPA compliance)? Do DFC targets translate into mature forest conditions that meet water quality standards and other goals?	Ongoing RipStream analysis
E5		Effectiveness, Other	Are forest practice rules effectively protecting headwater (small Type N) streams such that local and downstream beneficial uses are protected? Key issues include effects on stream temperature, large wood recruitment, stream flow, sediment delivery, mass wasting initiation and debris torrent processes, macroinvertebrates, and how those effects are translated downstream.	Ongoing Trask analysis and Hinkle analyses; Li et al., 2011; Zegre, 2008; Otis, 2007
E6		Effectiveness, Other	What are the effects of harvesting multiple contributing small Type N streams on temperature, flow, and sediment, and large wood regimes of receiving Type F streams?	Ongoing Trask and Hinkle analyses; Zegre, 2008; Otis, 2007
E7		Effectiveness	When implemented, do rules preventing slash loading in headwater streams protect water quality, fish habitat of downstream Type F streams, and minimize debris torrents?	Not started
E8		Effectiveness, Voluntary Implementation	Are large wood recruitment incentives (OPSW activity 4.5) providing desired results?	Burnett et al., 2008
E9		Effectiveness, Voluntary Implementation	Is the current voluntary program for placement of large wood structures in streams active enough to adequately address the need for large wood in streams?	ODF project initiated in 2015; Burnett et al., 2008

No.	Theme	Question Types	Questions	Summary of status of ODF-associated studies relevant to question
E10		Effectiveness	Do the current management practices for the riparian zone, which were designed to create a "desired future condition" some time from now, provide enough shade now to protect threatened and endangered salmonids?	Ongoing RipStream analysis, Groom et al., 2011a,b; Czarnomski et al., 2013;
E11		Effectiveness	How effective is large wood placement at enhancing fish habitat?	to be partially addressed in project initiated in 2015; Burnett et al., 2008
E12		Effectiveness, Voluntary Implementation	Are landowners leaving 25% of in-unit leave tree and additional voluntary retention along Type F streams and is this effectively meeting resource protection goals? (OPSW 3.6)	Not started
E13		Effectiveness	How effective are alternate buffer prescriptions (e.g., leave more on south-side, no large trees on small streams (?)) at achieving water quality, large wood recruitment, and desired future conditions goals?	partially addressed in Czarnomski et al., 2013, Dent and Walsh, 1997; Zwieniecki and Newton, 1999
E14		Effectiveness, Voluntary Implementation	Are riparian buffer requirements preventing or minimizing stream sedimentation and/or meeting water quality standards and TMDL load allocations in Type F streams?	Ongoing Trask analysis; Zegre, 2008; Zwieniecki and Newton, 1999; Dent and Walsh, 1997
E15		Compliance, Effectiveness	What are the implementation rates and effectiveness (maintaining stream temperature, hydrologic, sediment, and wood routing regimes) of limited RMAs on small Type N streams?	Implementation – Robben & Dent, 2002 Effectiveness – ongoing Trask

No.	Theme	Question Types	Questions	Summary of status of ODF-associated studies relevant to question
				analysis; Zegre, 2008; Otis, 2007; Kibler et al., 2013
E16		Effectiveness	In hardwood-dominated riparian stands, are silvicultural approaches resulting in increased conifer establishment?	Not started
E17	**Wetlands and Other Waters**	Effectiveness	When implemented, do the vegetation retention standards for significant and other wetlands protect wildlife habitat and hydrologic functions?	Not started
E18		Effectiveness	When implemented, do the riparian management area and protection measures for lakes maintain the functions and values of lakes, including those related to water quality, hydrologic functions, aquatic organisms, fish and wildlife?	Not started
E19		Effectiveness	When implemented, do the protection measures for "other" wetlands, seeps, and springs prevent soil and vegetation disturbances which would cause adverse effects on water quality, hydrologic function, and wildlife and aquatic habitat?	addressed in: Robben and Dent, 2002
E20	**Wildlife Habitat**	Effectiveness	When implemented, do the vegetation retention standards for significant and other wetlands protect wildlife habitat and hydrologic functions?	partially addressed in Weikel et al., 2014; Meininger, 2011; Jenkins, 2010
E21		Effectiveness, Validation	When implemented, do the riparian management area and protection measures for lakes maintain the functions and values of lakes, including those related to water quality,	addressed in: Weikel et al., 2014

No.	Theme	Question Types	Questions	Summary of status of ODF-associated studies relevant to question
			hydrologic functions, aquatic organisms, fish and wildlife?	
E22		Effectiveness	When implemented, do the protection measures for "other" wetlands, seeps, and springs prevent soil and vegetation disturbances which would cause adverse effects on water quality, hydrologic function, and wildlife and aquatic habitat?	not started
E23		Effectiveness		Trask Watershed study assessing this; Leuthold et al., 2012
E24		Effectiveness, Trend, Other	How effective are implemented leave tree requirements (ORS 527.676) at overall maintenance of wildlife, nutrient cycling, moisture retention and other resource benefits of retained wood? Is there a difference in effectiveness of clumped vs. scattered patterns?	addressed in: Isaacs et. al, 2005
E25		Effectiveness	Do implemented wildlife leave tree and downed wood requirements provide for wildlife habitat as intended?	Not started
E26		Effectiveness	How effective is downed wood at protecting wildlife (e.g., amphibians, reptiles, birds, and mammals)?	Not started
E27		Effectiveness	When implemented, do current forest practices protection measures adequately protect headwater amphibian species?	Not started.
E28		Effectiveness	What are the potential effects of forest practices on bald eagles nesting in Oregon?	Not started.
E29		Effectiveness, Trend, Validation	When implemented, do the protection measures for northern spotted owl nesting sites ensure that forest practices do not	Not started

No.	Theme	Question Types	Questions	Summary of status of ODF-associated studies relevant to question
			lead to resource site destruction, abandonment, or reduced productivity?	
			When implemented, do the protection measures for significant wetlands ensure that forest practices do not lead to resource site destruction or reduced productivity?	
E30	**Water Quality**	Effectiveness, Other	When implemented, do the protection measures for osprey ensure that forest practices do not lead to resource site destruction, abandonment, or reduced productivity?	Not started
E31		Effectiveness, Trend	When implemented, do the protection measures for great blue heron nesting sites ensure that forest practices do not lead to resource site destruction, abandonment, or reduced productivity?	Dent et al., 2008; Davis et al., 2015; Kibler et al., 2013; Otis, 2007; Zegre, 2008; Zwieniecki and Newton, 1999
E32		Effectiveness	Which species of predicted early seral and cavity dependent wildlife (e.g. western bluebird, house wren) are currently found as viable reproductive species post-logging? How effective are wildlife tree retention rules for producing habitat? In what proportion of harvest units do they occur?	Dent and Walsh, 1997; Zwieniecki and Newton, 1999
E33		Effectiveness		Ongoing Hinkle, Trask, RipStream, and Alsea analyses; addressed in: Groom et al., 2011a,b; Czarnomski et al., 2013; Dent and Walsh, 1997; Kibler et al., 2013; Zegre, 2008; Otis, 2007; Newton

No.	Theme	Question Types	Questions	Summary of status of ODF-associated studies relevant to question
				and Cole, 2013; Zwieniecki and Newton, 1999
			Do forest practices, including roads, under current rules meet all applicable water quality criteria established by DEQ, including those established by TMDLs, for water quality parameters affected by forest practices on fish and non-fish bearing water bodies?	
E34	**Roads and slope stability**	Effectiveness	If there are performance standards for roads that are measurable, repeatable, and enforceable, is there an analytical basis to find that attainment of these standards will ensure that forest roads do not contribute to non-attainment of water quality standards or harm T & E aquatic species?	partially addressed in ongoing Trask analyses
E35		Effectiveness	Do crossings installed under current guidance provide juvenile and adult fish passage over time?	Not started
E36		Effectiveness	How do legacy roads affect water quality?	not started
E37		Effectiveness	When implemented, how effective are road rules at controlling erosion and preventing delivery of sediment to streams?	partially addressed in Mills et al., 2003
E38		Effectiveness	Are different surfacing and road use practices effective at mitigating turbidity in streams and thereby attaining water quality standards?	Ongoing Trask analysis
E39		Effectiveness	Are forest practice erosion-related BMPs required by rules dealing with road construction, maintenance, and harvest activities, preventing and limiting surface erosion and landslides and sediment delivery to waters of the state?	Ongoing Trask analysis
E40		Compliance, Effectiveness	Are road waste disposal requirements protecting water quality and human health, and preventing road failure?	Not started

No.	Theme	Question Types	Questions	Summary of status of ODF-associated studies relevant to question
E41		Effectiveness	Are best management practices required by rules minimizing unacceptable increases in turbidity levels for domestic water systems?	Not started
E42		Effectiveness, Other	Are culvert replacement projects effective in restoring conditions beneficial to fish? What factors such as upstream habitat length and conditions, channel gradient, culvert design, etc. correlate with effectiveness?	not started
E43		Effectiveness	How much would trees clumped along debris flow-prone areas contribute to large wood needs or to minimizing failure risks?	not started
E44		Compliance, Effectiveness	Are human life and property adequately protected by High landslide hazard location rules?	not started
E45		Effectiveness, Validation, Other	Do current harvest practices, implemented in accordance with the FPA, contribute to an increased rate or magnitude of shallow rapid or deep-seated landslides that deliver sediment to waters of the state (and thereby impair water quality) and/or which threaten public safety?	partially addressed in Robison et al., 1999
E46		Effectiveness, Other	How does organic carbon loading from forest practices affect formation of trihalomethanes during the drinking water disinfection process?	not started
E47	**Pesticides**	Effectiveness	Do pesticide rules, when implemented, sufficiently protect homes, schools, fish-bearing streams, and drinking water?	not started
E48		Effectiveness, Other	Is water quality, including the integrity of aquatic communities and public health, being effectively protected when herbicides or insecticides are applied near streams as stipulated in rules and statutes?	Alsea Watershed study assessing this

No.	Theme	Question Types	Questions	Summary of status of ODF-associated studies relevant to question
E49		Effectiveness, Other	Is water quality protected from surfactants, carriers, and "inert" ingredients when chemicals are applied (in accordance with rules and statues) near streams?	Not started
E50		Effectiveness, Other	Is water quality, including the integrity of aquatic communities and public health, being effectively protected when forest management chemicals are applied (in accordance with rules and statutes) near small Type N streams? What are the downstream effects on water quality, aquatic biota, and human health if contamination does occur on small Type N streams?	Not started
E51		Effectiveness, Other	What concentrations of chemicals are found in streams when runoff events occur after the initial forest application of chemicals (in accordance with rules and statutes) near streams? Do these concentrations threaten water quality, aquatic biota, or public health, either locally or downstream?	Alsea Watershed study assessing this
E52	**Productivity and Reforestation**	Effectiveness, Trend	Are the reforestation rules, when implemented, resulting in productive forests with characteristic growth and stocking potentials for the site and species?	addressed in: Dent, 2001
E53		Effectiveness	Is reforestation after fire-related salvage logging successful in Eastern Oregon?	not started
E54		Effectiveness, Trend	Are FPA-related BMPs minimizing soil disturbance and compaction and maintaining long-term forest site productivity?	Not started
E55	**Other**	Effectiveness	How effective are ODF outreach efforts on cultural resource issues?	Not started

No.	Theme	Question Types	Questions	Summary of status of ODF-associated studies relevant to question
E56		Effectiveness, voluntary implementation	Are volunteer OPSW activities being implemented and are they effective at achieving the salmon protection and restoration goals? The multiple resources imbedded in this question are addressed through specific questions above.	Study slated to start in 2015
E57		Effectiveness, Compliance, Validation	Are Stewardship Plans effective and being implemented in accordance with the agreements?	Not started
E58		Effectiveness, Compliance, Voluntary Implementation	How can ODF better help protect cultural resources, given that ODF doesn't regulate cultural resources? How can ODF better ensure landowners are complying with State Cultural Resource Law given that ODF is not regulating these resources?	Not started

D.4 Bin B. In-scope Questions (Monitoring Unit support)

Table D.4 In-scope questions (Monitoring Unit in support role)

Theme	Question Type	Specific questions	Status of ODF-associated studies relevant to question
Riparian Structure and Function Questions	Trend, Validation	What levels of large wood recruitment are retained in riparian areas of small, medium, and large streams when measured under the current rules? Are the retained levels desirable?	Data collected for small and medium streams, analysis not begun
	Other, Trend, Validation	What are the ranges in large wood recruitment, instream large wood, shade and riparian characteristics that occur under "natural" disturbance regimes, under current conditions, and under current forest practice rules?	addressed in: Dent, 2001; Allen and Dent, 2001; Ongoing RipStream analysis

Theme	Question Type	Specific questions	Status of ODF-associated studies relevant to question
	Validation	What is the distribution of fish presence throughout the state?	Ongoing analysis by ODFW
	Other, Validation	Are large wood structures in streams effective in restoring conditions beneficial to fish? What factors such as geomorphology, structure design, etc. correlate with effectiveness?	Burnett et al., 2008
	Validation, Voluntary Implementation	Are efforts to place large wood in streams improving fish habitat?	Burnett et al., 2008
	Validation, Voluntary Implementation	1) Does OPSW activity 4.5 have a clear science-based objective for LW incentives? If not, what should they be? 2) Is there an ecological basis to find that the short term benefits of active wood placement justify trading riparian forest retention for such placement?	
		What would riparian conditions need to look like on both F and N streams for natural recruitment to approach the levels extant when native aquatic species evolved?	
	Validation, Other	Develop methods for predicting fish presence.	GIS (DEM-based) model developed
	Trend	What are the trends in wood density, key wood pieces, and wood volume at sites of artificially-placed large wood structure?	not started
	Validation	Do the stream improvement activities encouraged under the 1994 water protection rules and the OPSW contribute to salmon recovery?	Not started
	Other, Validation	What are the implications of preferentially retaining wildlife leave trees along streams in support of the Oregon Plan for Salmon and Watersheds? Examples include impact on	Not started

Theme	Question Type	Specific questions	Status of ODF-associated studies relevant to question
		upland species	
	Other, Trend	What are the regeneration characteristics (species composition, density, relationships to understory and overstory characteristics) within riparian areas managed to the FPA?	addressed in: Dent, 2001
	Other, Validation	Should Eastern Oregon have different Desired Future Conditions than Western Oregon?	Not started
	Other, Validation	Should riparian requirements differ based on site classes?	Not started
	Other, Validation	Should riparian requirements be measured from channel migration zones instead of high water level?	Not started
Wildlife	Validation, other	What proportion of very early seral habitat (1-5 years post logging or fire) in western Oregon forests occurs on private sector forest lands, thus, what is the relative importance of private sector habitat to early seral, cavity-dependent wildlife?	Not started
	Validation, other	Cavities created by hairy woodpeckers and norther flickers are critical habitat for early seral, secondary cavity nesters (e.g. bluebirds). What are the minimum numbers and characteristics of snags required by these two woodpecker species and how do those compare to current post harvest snag availability?	Not started
Water Quality	Validation, Trend, Other	With streams going in and out of non-federal forest land use, what are the best means to protect stream temperature given that other land uses have different riparian requirements?	Not started

Theme	Question Type	Specific questions	Status of ODF-associated studies relevant to question
	Trend	How do stream temperatures on forested streams vary over time and space?	Ongoing Hinkle, Trask, RipStream, and Alsea analyses; addressed in: Dent et al., 2008; Zwieniecki and Newton, 1999
	Other, Trend	Is there a threshold streamflow at which small Type N streams affect the temperature regime of downstream Type F streams (e.g., when they contribute 10% or more of the streamflow)? How do multiple harvests on Type Ns affect this regime?	not started; Otis, 2007; Zegre, 2008; Kibler et al., 2013;
	Other, Trend	What are the basin-level trends in stream temperature on a variety of basins? How does harvesting affect basin-level trends in stream temperature?	Ongoing Hinkle, Trask, and Alsea analyses; Otis, 2007; Zegre, 2008; Kibler et al., 2013;
	Other, Trend	Develop effective methods for scaling site-specific temperature impacts from multiple harvest operations to an evaluation of effects at the basin-scale.	Ongoing Hinkle, Trask analyses
	Validation	What levels of shade are retained under the current vegetation retention rules as compared with pre-harvest levels?	Ongoing Hinkle, Trask, RipStream, and Alsea analyses; addressed in: Allen and Dent, 2001; Dent, 2001; Dent and Walsh, 1997; Groom et al., 2011b
	Other, Trend	How do shade levels vary with stand, channel, valley type, and georegion?	addressed in: Allen and Dent, 2001
	Other, Trend, Validation	What are the ranges in stream temperature and shade provided under "historic" disturbance regimes and under current conditions?	addressed in: Allen and Dent, 2001; Dent, 2001; Dent and Walsh, 1997; Groom et al., 2011b; Dent, 2008; Otis, 2007; Zegre, 2008; Kibler et al., 2013; Newton and Cole, 2013; Zwieniecki and Newton, 1999
	Trend	How do stream temperatures on forested streams vary over time and space?	Ongoing Hinkle, Trask, RipStream, and Alsea analyses; addressed in: Dent

Theme	Question Type	Specific questions	Status of ODF-associated studies relevant to question
			et al., 2008
	Validation	How do localized increases in stream temperature affect aquatic biota?	Ongoing Hinkle, Trask, and Alsea analyses
	Validation	Are conditions on forest lands sufficient to support healthy aquatic communities?	partially addressed via Alsea, Hinkle, and Trask studies
Roads and slope stability	Other, Trend, Validation	What are the ranges in sediment delivery and routing in stream systems that occur under "historic" disturbance regimes and under current conditions?	Not started
	Effectiveness	Do crossings installed under current juvenile fish passage guidance have unique maintenance issues?	Not started
	Other, Trend	What are the frequency distributions of landslides, debris flows and channel impacts from forested land of various stand ages and management histories?	No additional work since Robison et. al, 1999
	Effectiveness, Other, Trend	What are the relative contributions of inherent and management-related sediment sources to the sediment budget of a variety of watersheds?	Ongoing Trask analysis
	Other, Trend, Validation	Develop information and analytic tools for evaluating the cumulative effects of forest harvests on stream sedimentation and turbidity.	addressed in: Mills et al., 2003
	Other, Validation	What factors affect debris-flow travel with potential impacts to homes, roads, and streams?	No additional work since Robison et. al, 1999
	Validation, Other	In forest practices, what is the role of root strength versus canopy alteration of water delivery in slope stability?	Not started
Pesticides	Other, Validation	Do reforestation rules encourage use of pesticides?	not started

Theme	Question Type	Specific questions	Status of ODF-associated studies relevant to question
	Other	Are pesticides adversely impacting plants important to Native Americans and browse species?	not started
	Validation	What level of contamination is injurious (including acute toxicity, chronic toxicity, and sub-lethal behavioral effects) to aquatic biota?	Not started
Air quality	Other	Has smoke from prescribed burning in regulated forest operations met the requirements of the clean air standards?	Not started
Other	Other, Trend, Validation	What are adverse impacts of monocultures on wildlife and culturally important plants?	not started

D.5 Bin C. Out of Scope Questions

Table D.5 Out of scope questions

Theme	Question Type	Specific questions	Status of ODF-associated studies relevant to question
Riparian Structure and Function Questions	Other	How does ODF identification of F streams correlate with ODFW fish distribution maps? Are streams likely to be used by fish, including currently degraded or blocked habitat which public policy intends to be restored, being consistently protected with F buffers?	Not started
	Other	How many miles of stream receive increased protection measures as a result of changing the stream classification from N to F or from N to NT?	Not started
	Other	How do riparian stand, channel and upland characteristics on non-federal forestlands vary by georegion, stream size, forest practice "era"?	Allen & Dent (2001) addresses some of this question

Theme	Question Type	Specific questions	Status of ODF-associated studies relevant to question
	Other	What are the relationships between trends in riparian condition, instream condition, and salmon populations over time?	Not started
	Other	How are the microclimates of riparian areas affected by harvesting under current rules?	Not started
Wildlife Habitat	Other	What is diversity within early seral habitat after reforestation?	Not started
	Other	Describe the species composition and abundance levels of wildlife and plant communities occurring in forest stands of varying seral stages, size classes, and landscape configurations in watersheds managed primarily for timber production.	Trask Watershed study will address some wildlife aspects
	Other	Develop methods for analyzing wildlife responses to stand- and landscape-level habitat conditions in managed watersheds.	Not started
	Other	Will current and projected future forest habitat conditions be sufficient to maintain viable populations of forest-dwelling wildlife species in Oregon?	Not started
	Other	Develop methods to assess and monitor elements of sustainable forestry and biodiversity conservation.	Not started
	Other	What "resource sites" still "need protection" under ORS § 527.710(3) of the FPA? i.e. are there areas used by state and federally listed threatened and endangered (T&E) species, "sensitive bird nesting, roosting and watering sites," "biological sites that are ecologically and scientifically significant," or "significant wetlands" that have not been inventoried and protected? NOTE: possible new listings of some salamanders, no resource sites have been designated for T&E fish.	

Theme	Question Type	Specific questions	Status of ODF-associated studies relevant to question
	Other, Validation	How well do we know where resource sites are?	Not started
	Other	Given that snags will have to be artificially created in private sector stands with histories of intensive management, and given that snags need to be in a suitable decay stage for woodpecker excavation immediately following harvest, how many years before harvest should snags be created (e.g. 5-10 yrs?)	Not started
	Other	What method of artificial snag creation works best in private industrial, short rotation forest management?	Not started
Water Quality	Other	What is the role of groundwater input and hyporheic flow in cooling stream reaches? What are the geomorphic characteristics of stream reaches in which subsurface flow contributes to cooling?	Trask and Hinkle Watershed
	Other	How does use of fire retardants in Oregon affect water quality?	Not started
Roads and slope stability	Other	Do current rules and guidance provide landowners and ODF with clear performance standards for forest roads that are measurable, repeatable, and enforceable? If not, what performance standards would meet these objectives?	
	Implementation	Is the road hazard and risk reduction project being implemented and resulting in improved road conditions?	Ongoing Trask analysis
	Other, Validation	How much large wood comes from upslope via debris flows?	Not started
Productivity and	Other	Is there a BMP for Swiss Needle Cast?	Not started

Theme	Question Type	Specific questions	Status of ODF-associated studies relevant to question
Reforestation			
Other	Other	What is the extent of environmental protection, economic, landscape impacts of the proposed NT designation that came out of FPAC?	Not started
	Other	What are the predictors of perenniality and fish presence and how does that affect the NT designation?	Not started
	Other	Can the FPMP aid in monitoring associated with certification programs?	Not started
	Other	How does stream discharge change post-fire?	Not started
	Other	How do natural conditions influence the impacts of logging on water quality?	Not started

References

Note: The Alsea, Hinkle, and Trask paired watershed studies have multiple theses and publications completed, and presentations given at conferences, in addition to ongoing analyses. Publications and presentations can be found at: http://watershedsresearch.org/results/ .

Allen, M., L. Dent. 2001. Shade Conditions Over Forested Streams In the Blue Mountain and Coast Range Georegions of Oregon. ODF Forest Practices Monitoring Program Technical Report #13.

Burnett, Kelly M., Guillermo R. Giannico, and Jeff Behan. 2008. *A Pilot Test of Systematic Review Techniques: Evaluating Whether Wood Placements in Streams of the Pacific Northwest Affect Salmonid Abundance, Growth, Survival or Habitat Complexity*. Report prepared by Institute for Natural Resources for Oregon Department of Forestry/State Forests.

Clements, P., J. Groom, J. Hawksworth. 2014. Oregon Department of Forestry Forest Practices Compliance Audit 2013.

Czarnomski, N., C.V. Hale, W.T. Frueh, M. Allen, J. Groom. 2013. Effectiveness of Riparian Buffers at Protecting Stream Temperature and Shade in Pacific Northwest Forests: A Systematic Review. Final Report September 2013.

Dent, L. 2001. Harvest Effects on Riparian Function Under Current Oregon Forest Practice Rules. ODF Forest Practices Monitoring Program Technical Report #12.

Dent, L., D. Vick, K. Abraham, S. Shoenholtz, S. Johnson. 2008. Summer temperature patterns in headwater streams of the Oregon Coast Range. *Journal of the American Water Resources Association* 44: 803-813.

Dent L., J.B.S. Walsh. 1997. Effectiveness of riparian management areas and hardwood conversions in maintaining stream temperature. ODF Forest Practices Technical Report 3.

Groom, J.D., L. Dent, and L.J. Madsen. 2011a. Stream temperature change detection for state and private forests in the Oregon Coast Range. *Water Resources Research* 47: W01501, doi:10.1029/2009WR009061.

Groom, J.D., L. Dent, and L.J. Madsen. 2011b. Response of western Oregon stream temperatures to contemporary forest management. *Forest Ecology and Management*, doi:10.1016/j.foreco.2011.07.012

Isaacs, F., R.G. Anthony, R.W. Krahmer, B.D. Callahan, J.P. Peck. 2005. Effects of Forest Management Practices on Bald Eagles Nesting on State and Private Land in Oregon. ODF Forest Practices Monitoring Technical Report #19.

Jenkins, S. R. 2010. Post-breeding habitat selection by songbirds in the headwaters of the Trask River, northwestern Oregon. Master's thesis, Oregon State University.

Kibler, KM., A. Skaugset, L.M. Ganio, M.M. Huso. 2013. Effect of contemporary forest harvesting practices on headwater stream temperatures: Initial response of the Hinkle Creek catchment, Pacific Northwest, USA. *Forest Ecology and Management* 310:680–Leuthold, N., M.J. Adams, J.P. Hayes. 2012. Short-Term Response of Dicamptodon tenebrosus Larvae to

Timber Management in Southwestern Oregon. The Journal of Wildlife Management 9999:1–10; 2011; DOI: 10.1002/jwmg.269

Li, J.L., S.L. Johnson, J.B. Sobota. 2011. Three responses to small changes in stream temperature by autumn-emerging aquatic insects. *Journal of the North American Benthological Society*, 30(2):474-484. 2011; DOI: 10.1899/10-024.1

Meininger, W. S. 2011. The Influence of Contemporary Forest Management on Stream Nutrient Concentrations in an Industrialized Forest in the Oregon Cascades. Master's Thesis, Oregon State University.

Mills, K., L. Dent, and J. Robben. 2003. Wet Season Road Use Monitoring Project Final Report. ODF Forest Practices Monitoring Program Technical Report #17.

Newton, M, L. Cole. 2013. "Stream Temperature and Streamside Cover 14-17 Years after Clearcutting along Small Forested Streams, Western Oregon." *Western Journal of Applied Forestry* 28(3) 107-115.

Otis, T. L. 2007. Processes That Influence the Downstream Propagation of Heat in Streams from Clearcut Harvest Units: Hinkle Creek Paired Watershed Study. Master's thesis, Oregon State University

Paul, J., L. Dent, M. Allen. 2002. Compliance With Fish Passage and Peak Flow Requirements at Stream Crossings Final Study Results. ODF Forest Practices Monitoring Program Technical Report #14.

Robben, J., L. Dent. 2002. Best Management Practices Compliance Monitoring Project: Final Report. ODF Forest Practices Monitoring Program Technical Report #15.

Robison, G.E., K.A. Mills, J. Paul, L. Dent, A. Skaugset. 1999. Storm Impacts and Landslides of 1996: Final Report. ODF Forest Practices Monitoring Program Forest Practices Technical Report #4.

Weikel, J., R. Krahmer, J. Cathcart. 2014. Compliance with Leave Tree and Downed Wood Forest Practices Act Regulations. ODF Forest Practices Monitoring Program Technical Report #20.

Zégre, N. P. 2008. Local and Downstream Effects of Contemporary Forest Harvesting on Streamflow and Sediment Yield. PhD dissertation, Oregon State University.

Zwieniecki, MA, M. Newton. 1999. Influence of streamside cover and stream features on temperature trends in forested streams of western Oregon. *Western Journal of Applied Forestry* 14: 106–113.

Appendix E: Information sources used for prioritizing Monitoring Questions

E.1 Stakeholder groups invited to participate in developing this update of the Monitoring Strategy

- Aquatic and Riparian Effectiveness Monitoring Program (combined USDA/US Forest Service and USDOI/Bureau of Land Management)
- Association of Oregon Loggers
- Committee for Family Forestlands (an Oregon Board of Forestry advisory committee)
- Forest Stewardship Council
- National Council for Air and Stream Improvement, Inc.
- National Oceanic and Atmospheric Administration/National Marine Fisheries Service
- Native American Tribes in Oregon (federally recognized)
- Network of Oregon Watershed Councils
- Oregon Department of Agriculture
- Oregon Department of Environmental Quality
- Oregon Department of Fish and Wildlife
- Oregon Department of Forestry (ODF): State Forests Division Staff, Private Forests Division Staff, field staff
- ODF/Private Forests Compliance Audit: External and Internal Review Committees
- Oregon Department of Health
- Oregon Department of Water Resources
- Oregon Forest and Industries Council
- Oregon Forest Resources Institute
- Oregon Small Woodlands Association
- Oregon State University (College of Forestry; Institute of Natural Resources; Watersheds Research Cooperative)
- Oregon Stream Protection Coalition (representing 25 different groups)
- Oregon Tree Farm System
- Oregon Watershed Enhancement Board
- Regional Forest Practices Committees (an Oregon Board of Forestry advisory committee)
- RipStream External Review Team
- Sustainable Forestry Initiative
- US Environmental Protection Agency
- US Geological Survey

E.2 Oregon Department of Forestry documents assessed[5]

- Forestry Program for Oregon

[5] Note: These documents were originally targeted to inform the prioritization process. However, we decided against using them in this process.

- Oregon Department of Forestry/Private Forests Division 2015-17 Ways and Means Presentation
- 2016 Private Forest Work Plan
- 2016 State Forests Work Plan
- 2016 Emerging Issues Work Plan
- FPA: statute and rules

E.3 Use of partner agency documents to inform the Strategy

Note: These documents were originally targeted to inform the prioritization process. However, we decided against using them in this process. The agencies' documents that we assessed were from:

- Columbia River Gorge Commission
- Independent Multidisciplinary Science Team
- Northwest Power and Conservation Council
- Oregon Department of Agriculture
- Oregon Department of Environmental Quality
- Oregon Department of Fish and Wildlife
- Oregon Department of Geology and Mineral Industries
- Oregon Department of Land Conservation and Development
- Oregon Parks and Recreation Department
- Oregon Department of State Lands
- Oregon Health Authority
- Oregon Office of Emergency Management
- Oregon State Historic Preservation Office
- Oregon Water Resources Department
- Oregon Watershed Enhancement Board
- Oregon's 10-year plan
- US Bureau of Land Management
- US EPA
- US Forest Service

Appendix F. List of Prioritized Questions

See Appendix D for methods used to develop these priorities.

F.1 Priorities of Implementation Questions

Table F.1.1 Priorities of Implementation Questions

(H=high priority, M=medium priority, L=low priority, R= remove since no votes)

#	Theme	Question	Votes[1]	Priority	2002 Update question (priority)[2]
I1	**Riparian Structure and Function Questions**	What fraction of riparian areas in forest operation areas are currently on track to meet FPA riparian "desired future condition" targets? For the fraction that is not on this track, what are the causes (e.g., due to legacy, blow-down, lack of hardwood-to-conifer conversion, insufficient FPA compliance)? Do DFC targets translate into mature forest conditions that meet water quality standards and other goals?	B,C,D,G	**H**	
I2		What are the compliance rates with felling conifers away from small Type N streams?	A	**L**	**14 (M)**
I3		Are large wood recruitment incentives (OPSW activity 4.5) providing desired results?	E	**L**	**9 (M)**
I4		Are the rules and guidance for the placement of large wood in streams implemented correctly?	A	**L**	**12 (L)**
I5		Is the current voluntary program for placement of large wood structures in streams active enough to adequately address the need for large wood in streams?	B	**L**	
I6		What is the implementation rate of no-harvest riparian areas in support of the Oregon Plan for Salmon and Watersheds (OPSW) or for other reasons? Where are these areas (geographically and by landownership type) and how much in excess of minimum requirements are the retained buffers?	E	**L**	**7 (H)**

#	Theme	Question	Votes[1]	Priority	2002 Update question (priority)[2]
I7		What is the implementation rate of active placement of large wood during forest operations?	-	**R**	
I8		Are landowners leaving 25% of in-unit leave tree and additional voluntary retention along Type F streams and is this effectively meeting resource protection goals? (OPSW 3.6)	E	**L**	**10 (M)**
I9		What are the compliance rates with the water protection rules?	C,E,G	**M**	**13 (L)**
I10		Are riparian buffer requirements preventing or minimizing stream sedimentation and/or meeting water quality standards and TMDL load allocations in Type F streams?	B,C,D,F,G	**H**	
I11		What are the implementation rates and effectiveness (maintaining stream temperature, hydrologic, sediment, and wood routing regimes) of limited RMAs on small Type N streams?	C,E	**M**	**16 (T)**
I12	**Wetlands & Oth. Wat.**	What are the compliance rates for rules designed to protect significant and other wetlands?	B,E,G	**M**	**27 (H)**
I13		What are the compliance rates for the water protection rules for lakes?	E	**L**	**44 (M)**
I14	**Wildlife Habitat**	Are wildlife tree retention rules implemented as intended?	A,C	**M**	
I15		What are the compliance rates with retention of wildlife trees and downed wood?	D	**L**	**32 (T)**

#	Theme	Question	Votes[1]	Priority	2002 Update question (priority)[2]
I16		What are the compliance rates for rules designed to protect threatened and endangered fish and wildlife species that use resource sites on forestlands (i.e., northern spotted owl nesting sites, bald eagle nesting sites, bald eagle roosting sites, and bald eagle foraging perches)?	B,D,F	**M**	**29 (T)**
I17		What are the compliance rates for rules designed to protect sensitive bird nesting, roosting, and endangered fish and wildlife species that use resource sites on forestlands (i.e., northern spotted owl nesting sites, bald eagle nesting sites, bald eagle roosting sites, and bald eagle foraging perches)?	-	**R**	**8 (M)**
I18		What are the compliance rates for rules designed to protect sensitive bird nesting, roosting, and watering sites (i.e., osprey nesting sites, great blue heron nesting sites)?	A	**L**	**31 (T)**
I19	**Roads and slope stability**	What are the compliance rates with juvenile fish passage requirements and guidelines?	B, D, F	**M**	**59 (M)**
I20		Are road waste disposal requirements protecting water quality and human health, and preventing road failure?	-	**R**	
I21		What are the compliance rates with BMPs for roads, skid trails, and high risk sites?	B, C, D, G	**H**	**66 (M)**
I22		What fraction of culverts in forest operation areas currently meet FPA standards? For the fraction that does not meet standards, what are the causes (e.g., legacy, recent storms, insufficient FPA compliance)?	A, B, D, E, G	**H**	

#	Theme	Question	Votes[1]	Priority	2002 Update question (priority)[2]
I23		Are culverts being designed to pass a 50-year peak flow? (OPSW activity 4.10)	-	**R**	**72 (L)**
I24		Are road crossings being installed with no greater than 15-foot fills (OPSW activity 4.11) unless there is prior approval?	-	**R**	**73 (H)**
I25		Are the upgraded stream crossing construction and fill requirements being implemented? (OPSW activity 4.12 OWEB)	-	**R**	**74 (H)**
I26		How often are leave trees clumped along debris flow-prone areas?	-	**R**	
I27		Are human life and property adequately protected by High landslide hazard location rules?	D	**L**	
I28		Are high-risk sites consistently identified during the forest practices notification process?	B, E	**M**	**65 (M)**
I29	**Pesticides**	Are pesticide rules being followed?	A, B, C, D, E, G	**H**	
I30	**Productivity and Reforest.**	Does compliance with reforestation requirements vary with site preparation methods?	A, G	**M**	
I31		What is the level of compliance with reforestation rules?	C, G	**M**	**81 (H)**
I32		What are the compliance rates with rules that are designed to maintain soil productivity?	A, G	**M**	**84 (M)**
I33	**Other**	Are we getting accurate assessments of compliance with rules by private non-industrial owners?	C, G	**M**	
I34		Are we getting accurate assessments of voluntary implementation from private non-industrial owners?	-	**R**	

#	Theme	Question	Votes[1]	Priority	2002 Update question (priority)[2]
I35		Are volunteer OPSW activities being implemented and are they effective at achieving the salmon protection and restoration goals? The multiple resources imbedded in this question are addressed through specific questions above.	-	**R**	**85 (T)**
I36		Are Stewardship Plans effective and being implemented in accordance with the agreements?	F	**L**	**88 (M)**
I37		Are streams consistently typed using the applicable physical criteria? What is the percentage of instances the applicable physical criteria accurately describe the full extent of the stream network that is likely to be used by fish at any life stage for some portion of the year?	C, D, G	**M**	
I38		How can ODF better help protect cultural resources, given that ODF doesn't regulate cultural resources? How can ODF better ensure landowners are complying with State Cultural Resource Law given that ODF is not regulating these resources?	F	**L**	

[1]A=OFIC (Oregon Forest and Industries Council); B=OSPC (Oregon Stream Protection Coalition); C=Independent voters; D=ODF (Oregon Department of Forestry); E= Agencies (federal and state agencies, other than ODF); F = Tribes; G = CAERT (Compliance Audit External Review Team)

[2]This denotes to which question in the 2002 Strategy it is similar (see section A.2), and what that question's priority was in 2002 (T=top, H=high, M=medium, L=low)

F.2 Priorities of Effectiveness Questions

Table F.2.1 Priorities of Effectiveness Questions

(H=high priority, M=medium priority, L=low priority, R= removed since no votes)

	Theme	**Question**	**Votes[1]**	**2016 Priority**	**2002 Update question (priority)[2]**
E1	**Riparian Structure and Function Questions**	When implemented, how effective are (new) riparian prescriptions (voluntary or regulatory) at protecting water quality, providing large wood recruitment and attaining desired future conditions?	C, D, E	**H**	
E2		Do the riparian rules promote streamside forest stand structure and large wood recruitment levels that mimic mature riparian stand conditions?	B	**L**	**2 (T)**
E3		Do current riparian management rules and voluntary implementation supply large wood to higher order streams (including non-wadeable streams and estuary habitats) at rates sufficient to maintain or restore habitat complexity? If not, how long will this process take?	E	**L**	
E4		What fraction of riparian areas in forest operation areas are currently on track to meet FPA riparian "desired future condition" targets? For the fraction that is not on this track, what are the causes (e.g., due to legacy, blow-down, lack of hardwood-to-conifer conversion, insufficient FPA compliance)? Do DFC targets translate into mature forest conditions that meet water quality standards and other goals?	C, D, E	**H**	
E5		Are forest practice rules effectively protecting headwater (small Type N) streams such that local and downstream beneficial uses are protected? Key issues include effects on stream temperature, large wood recruitment, stream flow, sediment delivery, mass wasting initiation and debris torrent processes, macroinvertebrates, and how those effects are translated downstream.	B, C, D, E	**H**	**3 (T)**

	Theme	Question	Votes[1]	2016 Priority	2002 Update question (priority)[2]
E6		What are the effects of harvesting multiple contributing small Type N streams on temperature, flow, and sediment, and large wood regimes of receiving Type F streams?	-	**R**	**5 (H)**
E7		When implemented, do rules preventing slash loading in headwater streams protect water quality, fish habitat of downstream Type F streams, and minimize debris torrents?	-	**R**	**6 (H)**
E8		Are large wood recruitment incentives (OPSW activity 4.5) providing desired results?	-	**R**	**9 (M)**
E9		Is the current voluntary program for placement of large wood structures in streams active enough to adequately address the need for large wood in streams?	B	**L**	
E10		Do the current management practices for the riparian zone, which were designed to create a "desired future condition" some time from now, provide enough shade now to protect threatened and endangered salmonids?	C	**L**	
E11		How effective is large wood placement at enhancing fish habitat?	E	**L**	**11 (L)**
E12		Are landowners leaving 25% of in-unit leave tree and additional voluntary retention along Type F streams and is this effectively meeting resource protection goals? (OPSW 3.6)	B, D	**M**	**10 (M)**
E13		How effective are alternate buffer prescriptions (e.g., leave more on south-side, no large trees on small streams (?)) at achieving water quality, large wood recruitment, and desired future conditions goals?	C	**L**	
E14		Are riparian buffer requirements preventing or minimizing stream sedimentation and/or meeting water quality standards and TMDL load allocations in Type F streams?	B, C	**M**	
E15		What are the implementation rates and effectiveness (maintaining stream temperature, hydrologic, sediment, and wood routing regimes) of limited RMAs on small Type N streams?	-	**R**	**16 (T)**
E16		In hardwood-dominated riparian stands, are silvicultural approaches resulting in increased conifer establishment?	A	**L**	**23 (H)**

	Theme	Question	Votes[1]	2016 Priority	2002 Update question (priority)[2]
E17	**Wetlands and Other Waters**	When implemented, do the vegetation retention standards for significant and other wetlands protect wildlife habitat and hydrologic functions?	B	**L**	**26 (H)**
E18		When implemented, do the riparian management area and protection measures for lakes maintain the functions and values of lakes, including those related to water quality, hydrologic functions, aquatic organisms, fish and wildlife?	-	**R**	**45 (M)**
E19		When implemented, do the protection measures for "other" wetlands, seeps, and springs prevent soil and vegetation disturbances which would cause adverse effects on water quality, hydrologic function, and wildlife and aquatic habitat?	-	**R**	**46 (L)**
E20	**Wildlife Habitat**	How effective are implemented leave tree requirements (ORS 527.676) at overall maintenance of wildlife, nutrient cycling, moisture retention and other resource benefits of retained wood? Is there a difference in effectiveness of clumped vs. scattered patterns?	A, C, D	**H**	
E21		Do implemented wildlife leave tree and downed wood requirements provide for wildlife habitat as intended?	-	**R**	**39 (H)**
E22		How effective is downed wood at protecting wildlife (e.g., amphibians, reptiles, birds, and mammals)?	A	**L**	
E23		When implemented, do current forest practices protection measures adequately protect headwater amphibian species?	-	**R**	**41 (H)**
E24		What are the potential effects of forest practices on bald eagles nesting in Oregon?	-	**R**	**28 (T)**
E25		When implemented, do the protection measures for northern spotted owl nesting sites ensure that forest practices do not lead to resource site destruction, abandonment, or reduced productivity?	-	**R**	**33 (H)**

	Theme	Question	Votes[1]	2016 Priority	2002 Update question (priority)[2]
E26		When implemented, do the protection measures for significant wetlands ensure that forest practices do not lead to resource site destruction or reduced productivity?	-	**R**	**34 (H)**
E27		When implemented, do the protection measures for osprey ensure that forest practices do not lead to resource site destruction, abandonment, or reduced productivity?	-	**R**	**35 (H)**
E28		When implemented, do the protection measures for great blue heron nesting sites ensure that forest practices do not lead to resource site destruction, abandonment, or reduced productivity?	-	**R**	**36 (H)**
E29		Which species of predicted early seral and cavity dependent wildlife (e.g. western bluebird, house wren) are currently found as viable reproductive species post-logging? How effective are wildlife tree retention rules for producing habitat? In what proportion of harvest units do they occur?	A, C	**M**	
E30	**Water Quality**	Do forest practices, including roads, under current rules meet all applicable water quality criteria established by DEQ, including those established by TMDLs, for water quality parameters affected by forest practices on fish and non-fish bearing water bodies?	B, C, D, E	**H**	
E31		What are spatiotemporal responses and range of variability of elevated stream temperatures moving downstream, and how do these responses affect water quality of receiving reaches?	-	**R**	
E32		Do hardwood conversions meet water quality standards for stream temperature?	-	**R**	**50 (T)**
E33		Are FPA-related best management practices resulting in stream temperature increases at the site or watershed levels such that water quality criteria are exceeded?	-	**R**	**49 (T)**
E34	**Roads and slope stability**	If there are performance standards for roads that are measurable, repeatable, and enforceable, is there an analytical basis to find that attainment of these standards will ensure that forest roads do not contribute to non-attainment of water quality standards or harm T & E aquatic species?	-	**R**	
E35		Do crossings installed under current guidance provide juvenile and adult fish passage over time?	A	**L**	**57 (T)**
E36		How do legacy roads affect water quality?	-	**R**	

	Theme	Question	Votes[1]	2016 Priority	2002 Update question (priority)[2]
E37		When implemented, how effective are road rules at controlling erosion and preventing delivery of sediment to streams?	B, D	**M**	
E38		Are different surfacing and road use practices effective at mitigating turbidity in streams and thereby attaining water quality standards?	-	**R**	**60 (T)**
E39		Are forest practice erosion-related BMPs required by rules dealing with road construction, maintenance, and harvest activities, preventing and limiting surface erosion and landslides and sediment delivery to waters of the state?	E	**L**	**62 (H)**
E40		Are road waste disposal requirements protecting water quality and human health, and preventing road failure?	-	**R**	
E41		Are best management practices required by rules minimizing unacceptable increases in turbidity levels for domestic water systems?	-	**R**	**61 (M)**
E42		Are culvert replacement projects effective in restoring conditions beneficial to fish? What factors such as upstream habitat length and conditions, channel gradient, culvert design, etc. correlate with effectiveness?	A, E, F	**H**	
E43		How much would trees clumped along debris flow-prone areas contribute to large wood needs or to minimizing failure risks?	-	**R**	
E44		Are human life and property adequately protected by High landslide hazard location rules?	D	**L**	

	Theme	Question	Votes[1]	2016 Priority	2002 Update question (priority)[2]
E45		Do current harvest practices, implemented in accordance with the FPA, contribute to an increased rate or magnitude of shallow rapid or deep-seated landslides that deliver sediment to waters of the state (and thereby impair water quality) and/or which threaten public safety?	B, E	**M**	
E46		How does organic carbon loading from forest practices affect formation of trihalomethanes during the drinking water disinfection process?	-	**R**	
E47	**Pesticides**	Do pesticide rules, when implemented, sufficiently protect homes, schools, fish-bearing streams, and drinking water?	-	**R**	
E48		Is water quality, including the integrity of aquatic communities and public health, being effectively protected when herbicides or insecticides are applied near streams as stipulated in rules and statutes?	B, E	**M**	**76 (L)**
E49		Is water quality protected from surfactants, carriers, and "inert" ingredients when chemicals are applied (in accordance with rules and statues) near streams?	-	**R**	**79 (M)**
E50		Is water quality, including the integrity of aquatic communities and public health, being effectively protected when forest management chemicals are applied (in accordance with rules and statutes) near small Type N streams? What are the downstream effects on water quality, aquatic biota, and human health if contamination does occur on small Type N streams?	D	**L**	**77 (M)**
E51		What concentrations of chemicals are found in streams when runoff events occur after the initial forest application of chemicals (in accordance with rules and statutes) near streams? Do these concentrations threaten water quality, aquatic biota, or public health, either locally or downstream?	C, F	**M**	**78 (M)**

	Theme	Question	Votes[1]	2016 Priority	2002 Update question (priority)[2]
E52	**Productivity and Reforestation**	Are the reforestation rules, when implemented, resulting in productive forests with characteristic growth and stocking potentials for the site and species?	A	**L**	**82 (L)**
E53		Is reforestation after fire-related salvage logging successful in Eastern Oregon?	A, D	**M**	
E54		Are FPA-related BMPs minimizing soil disturbance and compaction and maintaining long-term forest site productivity?	A	**L**	**83 (M)**
E55	**Other**	How effective are ODF outreach efforts on cultural resource issues?	A, F	**M**	
E56		Are volunteer OPSW activities being implemented and are they effective at achieving the salmon protection and restoration goals? The multiple resources imbedded in this question are addressed through specific questions above.	F	**L**	**85 (T)**
E57		Are Stewardship Plans effective and being implemented in accordance with the agreements?	-	**R**	**88 (M)**
E58		How can ODF better help protect cultural resources, given that ODF doesn't regulate cultural resources? How can ODF better ensure landowners are complying with State Cultural Resource Law given that ODF is not regulating these resources?	F	**L**	

[1]A=OFIC (Oregon Forest and Industries Council); B=OSPC (Oregon Stream Protection Coalition); C=Independent voters; D=ODF (Oregon Department of Forestry); E= Agencies (federal and state agencies, other than ODF); F = Tribes;

[2]This denotes to which question in the 2002 Strategy it is similar (see section A.2), and what that question's priority was in 2002 (T=top, H=high, M=medium, L=low)

Table F.3 Question pairs that are the same or similar on implementation and effectiveness lists

(bold indicates it was prioritized, with the priority listed in parentheses; H=high, M=medium, L=low)

Implementation Question	**Same/similar Effectiveness Question**
I1 (H)	**E4 (H)**
I3 (L)	E8
I5 (L)	**E9 (L)**
I7	**E11 (L)**
I8 (L)	**E12 (M)**
I10 (H)	**E14 (M)**
I11 (M)	E15
I13 (L)	E18
I15 (L)	E21
I19 (M)	**E35 (L)**
I20	E40
I26	E43
I27 (L)	**E44 (L)**
I32 (M)	**E54 (L)**
I35	**E56 (L)**
I36 (L)	E57
I38 (L)	**E58 (L)**

Appendix G. Feedback on the Strategy

Feedback from all parties on various stages of the Monitoring Strategy are available upon request.