

DOCUMENT ORGANIZATION AND TABLE OF CONTENTS

DOCUMENT ORGANIZATION

Chapter 1 describes the “purpose and need” for action, identifies the project area, summarizes the proposed action, lists public issues surrounding the proposed action and discusses other considerations.

Chapter 2 presents and compares the alternatives, including the no-action alternative, and mitigation and monitoring measures.

Chapter 3 describes the environment that could be affected by each alternative and the direct, indirect, and cumulative effects likely to occur with implementation.

Chapter 4 lists preparers, summarizes the public involvement process and identifies recipients of the DEIS.

References lists the literature cited in the DEIS

The Glossary defines terms used in the DEIS.

Acronyms defines acronyms and abbreviations used in the DEIS

The Index provides page number references for key topics discussed in the DEIS

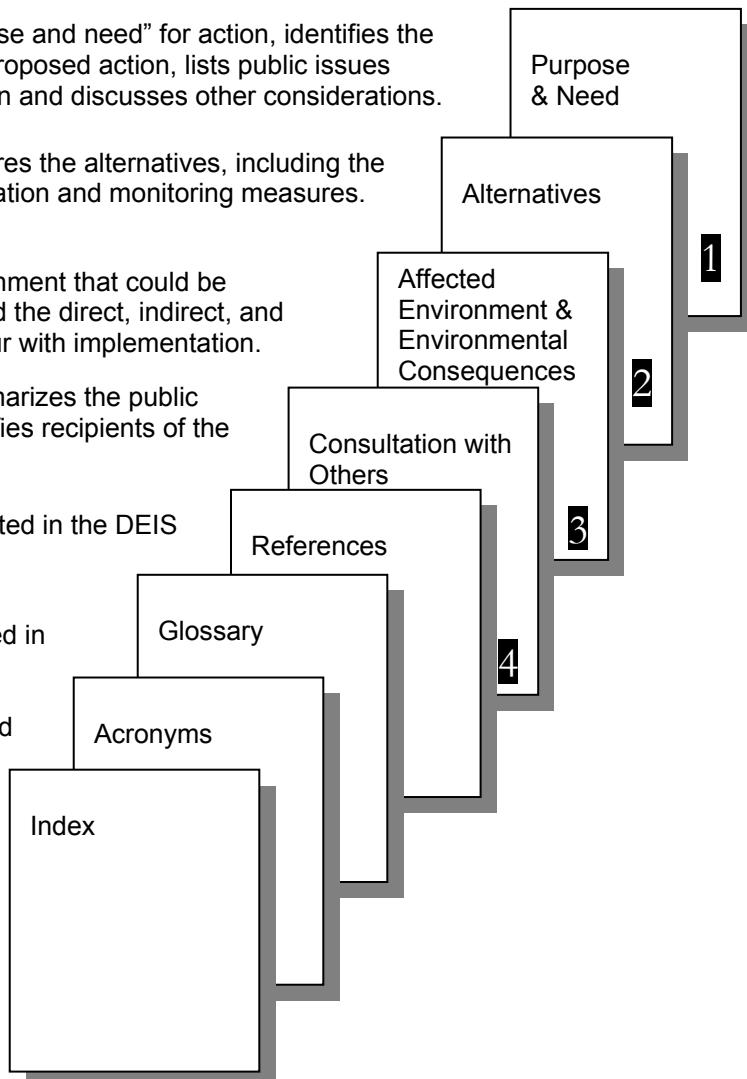


TABLE OF CONTENTS

CONTENTS	PAGE
SUMMARY	Summary - 1
INTRODUCTION - CHAPTER 1	1
Project Area Overview	1
Purpose of And Need For The Action.....	6
Element 1- Water Quality.....	6
Element 2- Recreational Fishery.....	8
Proposed Action	10
Decisions To Be Made Based On This Analysis	12
Relationship To Forest Plans,The Project Record, and The Diamond Lake/Lemolo Lake Watershed Analysis	12
Interagency Cooperation	13
Scoping	14
Significant Issues	15
Other Issues	17
INTRODUCTION - CHAPTER 2	21
Alternatives Considered In Detail.....	21
Alternative 1	21
Alternative 2	21
Alternative 3	30
Alternative 4	31
Best Management Practices, Management Requirements, Mitigation Measures, And Monitoring.....	33
Permits And Authorizations	41
Summary And Comparison of Alternatives	42
Alternatives Considered, But Eliminated From Detailed Study	49
INTRODUCTION - CHAPTER 3	57
Activities That Contribute To Cumulative Effects.....	57
Geological Environment	68
Aquatic Environment.....	69
Water Quality Regulations And Beneficial Uses	69
Aquatic Conservation Strategy	71
<i>Surface Water - Lake Ecology</i>	71
Background And Limnological Investigations.....	72
Lake Morphometry And Sediments.....	73
Conclusions	80
Water Temperature And Thermal Properties	81
Conclusions	83
Water Quality (Dissolved Oxygen, Nutrients, Alkalinity And pH)	84
Conclusions	100
Light And Transparency	102
Conclusions	106
<i>Surface Water - Stream Ecology</i>	106
Streamflow Regime	107
Conclusions	118
Water Quality	119

	PAGE
Conclusions	127
Dissolved Oxygen And pH	128
Aquatic Conservation Strategy - Water Quality	134
Channel Morphology And Fluvial Erosion	134
Conclusions	139
Aquatic Biology	140
Phytoplankton And Primary Production.....	140
Conclusions	151
Aquatic Macrophytes.....	151
Conclusions	158
Zooplankton	158
Conclusions And ACS Consistency	170
Benthic Organisms.....	172
Conclusions And ACS Consistency	181
Fish And Fish Habitat	182
Forest Plan Riparian Prescriptions C2-I And C2-IV	201
Potential Cumulative Effects Common To All Alternatives	205
Conclusions	206
ACS Consistency	208
Biological Evaluation of PETS Aquatic Species	210
Essential Fish Habitat	211
Groundwater	218
Groundwater Investigation.....	220
Water Quality - Water Chemistry	226
Conclusions	229
Groundwater Quantity - Groundwater Discharge And Recharge	229
Conclusions	232
Terrestrial Environment	233
Terrestrial Vegetation	233
Noxious Weeds	234
Threatened, Endangered, And Sensitive Plants	236
Survey And Manage.....	241
Wetland Plant Ecology.....	246
Summary of Effects To Wetland Plants.....	254
Wildlife	254
Background: Toxins And Wildlife.....	254
PETS Species	258
Northern Bald Eagle	263
Conclusions	268
Survey And Manage Species.....	286
Crater Lake Tightcoil Snail	288
Conclusions	290
Waterbirds.....	296
Reptiles And Amphibians	299
Bats	302
Other Mammals	305
Summary	307
Social Environment	308
Human Health Risk	308

	PAGE
Toxicity of Algae Blooms To Humans.....	308
Toxicity of Rotenone To Humans	310
Toxic Algal Blooms	314
Rotenone.....	319
Overview And Comparison Of Toxicity Risks	327
<i>Recreation</i>	328
2003 Recreation Survey Data	331
Sense of Place	331
Recreation Visitation	335
Summary Of Alternatives Effects On Recreation	346
<i>Economics</i>	347
Regional Population And Economic Indicators	348
Economic Structure	348
Diamond Lake Developed Recreation Facilities	350
Effects Of The Fishery Decline On Local Economic Activity	354
Effects On Local Economic Activity	355
Effects On Diamond Lake Developed Recreation Facilities	357
Project Implementation Costs.....	358
Unavoidable Adverse Impacts	360
Irreversible and Irrecoverable Commitments of Resources.....	362
Short Term and Long Term Productivity.....	362
<i>Specifically Required Disclosures</i>	363
Public and Worker Safety	363
Cultural Resources	363
Unique Habitats	363
Wetlands and Floodplains.....	363
Prime Farmlands, Rangelands, forestlands or Parklands.....	363
Potential or Unusual Expenditures of Energy	363
Conflicts with Plans or Policies of Other Jurisdictions	364
Consumers, Civil Rights, Minority Groups, and Women	364
Environmental Justice	364
INTRODUCTION - CHAPTER 4	365
Diamond Lake Restoration Project Interdisciplinary Team	365
Others Contributing Specialists Reports	367
Other Contributors And Reviewers	368
Consultation With Tribes	369
Regulatory Agencies That Were Consulted	369
List Of Persons And Agencies Who Participated In The Planning Process Either At Open Houses, Public Forums, Meetings, Field Trips Or Who Wrote Letters Of Input	370
Distribution Of The Draft EIS	378
Diamond Lake Restoration Public Involvement Process	381

List of Tables.......... **PAGE**

Table 1. Required Permits/Authorization for Alternatives 2 and 3 and Connected Actions	41
Table 2. Authorizations for Alternative 4.	42
Table 3. Comparison of Alternatives at Meeting Water Quality Element 1 of Purpose and	

	PAGE
Need	43
Table 4. Comparison of Alternatives at Meeting Recreational Fishery Element 2 of Purpose and Need	44
Table 5. Comparison of Alternatives at Responding to Fish Stocking Issue 1	45
Table 6. Comparison of Alternatives at Responding to Non-Target Species Issue 2....	45
Table 7. Comparison of Alternatives at Responding to Water Quality Issue 3	46
Table 8. Comparison of Alternatives at Responding to Wetland Ecology Issue 4	48
Table 9. Past Management Activities in the Cumulative Effects Analysis Area.	58
Table 10. Present Management Activities in the Cumulative Effects Analysis Area....	63
Table 11. Reasonably Foreseeable Management Activities in the Cumulative Effects Analysis Area.	65
Table 12. Water Quality Limited Streams and Water Bodies Within and Downstream of the Project Boundary	70
Table 13. Morphometry of Diamond Lake	74
Table 14. Summary of Water Quality Data for Diamond Lake	84
Table 15. Persistence of Rotenone and Other Organic Compounds in Water and Sediment Impoundments Treated with 2 mg/L Rotenone Formulation	96
Table 16. Comparison of Alternatives Effects on Summer pH in Diamond Lake	101
Table 17. Comparison of Alternatives Effects on pH Delivered from and a By-product of Primary Productivity of Diamond Lake.	131
Table 18. Lake Creek Stream Channel Characteristic	135
Table 19. Comparison of Alternatives Effects on Stream Channel Morphology	140
Table 20. Summary of Alternative Effects on Zooplankton Populations	171
Table 21. Summary of Alternative Effects on Benthic Organism Populations.....	182
Table 22. Early Stocking in Diamond Lake	187
Table 23. Diamond Lake Fish Stocking Data from 1955-1990	188
Table 24. Recent Fish Stocking Information for Diamond Lake.	190
Table 25. Summary of Alternative Effects on Fish Populations	207
Table 26. Biological Evaluation and Effects Determinations for PETS Aquatic Species ...	210
Table 27. Matrix of Pathways and Indicators for the Middle North Umpqua 5 th Field Watershed	217
Table 28. Actual or Predicted Groundwater Flow Reversal for Diamond Lake Monitoring Wells	224
Table 29. Comparison of Alternatives Effects on Groundwater	232
Table 30. Sensitive Species with Potential Habitat in the Project Area	237
Table 31. Plant Species Occurring in the South Shore Diamond Lake Wetland Complex	248
Table 32. Summary of Effects of Each Alternative to Wetland Plants in Diamond Lake	254
Table 33. Bird Mortality from Algal Toxins	255
Table 34. Prefield Review and Biological Evaluation Summary Table.	260
Table 35. Reproductive History of Bald Eagle Nest Sites at Diamond Lake	264
Table 36. Waterbirds Detected in Numbers Greater than 10 During the 2000-2002 Surveys at the South Shore Picnic Area and South Shore Meadows Survey Points on Diamond Lake	297
Table 37. Potential Bat Species at Diamond Lake and their Habits and Habitats	303
Table 38. Other Mammals at Diamond Lake and their Habits and Habitats	305

	PAGE
Table 39. Determination of Effects to Threatened, Endangered, and Sensitive Wildlife Species	307
Table 40. Summary of the Toxicity Information Available on Algae Toxins	310
Table 41. Human Health Standards, Risk-based Safe Levels, and Detection Limits for Rotenone and Other Associated Ingredients in Drinking Water.	313
Table 42. Summary of Exposure Risks to the Algal Toxins Associated with the Diamond Lake Restoration	319
Table 43. Comparison of Alternatives for Potential Worst-Case Human Health Impacts	327
Table 44. Summary Information for Six SOP Units in the Diamond Lake Restoration Project Area	332
Table 45. Annual Occupancy at Diamond Lake Campgrounds from 1989-2003	335
Table 46. Annual Angler Trips at Diamond Lake	336
Table 47. Alternative 1: Expected Changes in the Diamond Lake Recreational Fishery from 2004-2009	339
Table 48. Alternative 2: Expected Changes in the Diamond Lake Recreational Fishery from 2004-2009	341
Table 49. Alternative 3: Expected Changes in the Diamond Lake Recreational Fishery from 2004-2009	344
Table 50. Alternative 4: Expected Changes in the Diamond Lake Recreational Fishery from 2004-2009	345
Table 51. Summary of Alternative Effects on Recreation Use	346
Table 52. Population and economic indicators for Oregon and the three Counties in the Diamond Lake Economic Area.....	348
Table 53. 2001 Employment by Industry for Oregon and the three Counties in the Diamond Lake Economic Area	349
Table 54. Travel Impacts for Oregon and the three Counties in the Diamond Lake Economic Area	350
Table 55. Diamond Lake Forest Service Campground Revenues	351
Table 56. Angler trips at Diamond Lake.....	354
Table 57. Trip Related Per Day Angler Expenditure Profiles for Expenditures Within the Local Area.	355
Table 58. Estimated Local Economic Activity Associated with the Predicted Number of Total Angler Trips by Alternative.....	356
Table 59. Estimated Project Implementation Costs by Alternative	359

List of Figures	PAGE
------------------------------	-------------

Figure 1. Diamond Lake at the Base of Mt. Thielsen	2
Figure 2. Project Area Location on the Diamond Lake Ranger District, Umpqua National Forest.	3
Figure 3. Diamond Lake Restoration Project Area Within the Analysis Area	4
Figure 4. Diamond Lake Restoration Project Area.....	5
Figure 5. Diamond Lake Bathymetric Map	74
Figure 6. Diamond Lake Area by Depth	75
Figure 7. Sediment Accumulation Rate.....	76
Figure 8. Area of Exposed Sediment at Time of Maximum Draw Down.	78
Figure 9. Temperature Vertical Profile Showing Epilimnion, Metalimnion, and Hypolimnion During Typical Summer Thermal Stratification.	81

	PAGE
Figure 10. Typical seasonal temperature profiles from Diamond Lake	83
Figure 11. Dissolve Oxygen Profiles Showing Seasonal Changes in the Hypolimnion....	86
Figure 12. Average Concentration of Total Dissolved Phosphorus and Orthophosphate 1992 - 2002	88
Figure 13. Typical seasonal changes in the concentration of ammonia (NH_3) and dissolved oxygen in the hypolimnion of Diamond Lake in 2001	91
Figure 14. Average Values Summer Season Values of Total Kjeldahl Nitrogen and Nitrate in Epilimnion of Diamond Lake, and the Streams; Lake Creek, Silent Creek and Short Creek	92
Figure 15. Diamond Lake pH Vertical Profiles Measured by DEQ in 2001	94
Figure 16. Concentration of chlorophyll <i>a</i> (0-1 m depth) and Secchi Disk Transparency (Summer 2002)	103
Figure 17. Lake Creek Historical Hydrograph for Mean Monthly Streamflow.....	108
Figure 18. Lake Creek Mean-Daily Streamflow for the Period of Record in Comparison to the 1.5 Year Bankfull Flow of 110 Cubic Feet per Second	110
Figure 19. . Referenced Locations on Lake Creek and the Environmental Effects of a Lake Draw Down.....	112
Figure 20. Estimated Duration of the Draw Down Phase with Higher Streamflow in Lake Creek to Drain Diamond Lake.....	113
Figure 21. Simulated Mean Daily Flow for Alternatives 2 and 3 over the Project Period in Comparison to Actual Mean Daily Flow from the Lake Creek Gaging Station	114
Figure 22. Mean Monthly Flow at North Umpqua River Below Lemolo Dam, USGS Gaging Station 14313500 Before and After Dam Operation	118
Figure 23. Nitrogen and Phosphorus Concentrations (mg/L) in Lake Creek at Outlet and Mouth	123
Figure 24. Phytoplankton Biovolume During 2003	141
Figure 25. Phytoplankton Percent Composition During 2003	142
Figure 26. Phytoplankton Primary Production Variation Over Time and Depth	147
Figure 27. Distribution of Aquatic Macrophytes in Diamond Lake Based Upon Hydroacoustic Sampling in 2002	152
Figure 28. Representative Examples (and relative sizes) of the Three Major Groups of Zooplankton in Freshwaters.....	159
Figure 29. The Relationship Between Zooplankton and Fish in Diamond Lake (modeled from data collected at Diamond Lake).....	161
Figure 30. Benthic Production in Diamond Lake From 1946 to 1977	173
Figure 31. Fish Species Currently in Diamond Lake.	185
Figure 32. Geologic Map of Diamond Lake, Showing the Drift, Lacustrine, and Ash Flow Deposits.	219
Figure 33. Shallow and Deep Aquifers	221
Figure 34. Ground Water Monitoring Well Locations in the Shallow Unconfined Aquifer at Diamond Lake	222
Figure 35. Changes in Ground Water Flow Patterns Around a Lake	223
Figure 36. Hydrographs for Teal and Horse Lakes	231
Figure 37. Rare Plant Sites Within the Project Area	238
Figure 38. Goblin's Gold Moss	242
Figure 39. California Elfin Saddle	243
Figure 40. Wetlands Within the Project Area	247
Figure 41. South Shore Wetland Complex at Diamond Lake	249
Figure 42. Wetland complex bordering Lemolo Lake illustrates the abundance of Bog	249

	PAGE
Birch	250
Figure 43. Map Showing Affected Area of Lake Creek From Drying After Draw Down Is Complete	252
Figure 44. Fishing boats at Diamond Lake	328
Figure 45. Sense of Place Units within the Diamond Lake Restoration Project Area ..	334
Figure 46. Declining Angler Trips at Diamond Lake	337
Figure 47. Diamond Lake Resort Total Sales for the Shoulder (April-June, Sept. & Oct), Peak (July & August) and Total Fishing Season (April-October), 1986-2002	352
Figure 48. Diamond Lake Resort Marina Sales for the Shoulder (April-June, Sept. & Oct), Peak (July & August) and Total Fishing Season (April-October), 1986-2002	353
REFERENCES.....	References - 1
GLOSSARY	Glossary - 1
ACRONYMS.....	Acronyms - 1
INDEX	Index - 1

APPENDICES - available on-line, via CD, or by request (for paper copy).

Agency Roles and Responsibilities.....	Appendix - A
Best Management Practices Checklist	Appendix - B
Terrestrial Specialists Reports	Appendix - C
Aquatic Specialists Reports	Appendix - D
Social Specialists Reports	Appendix - E