

*Coastal Watershed Planning Assessment Program*



**Big River  
Basin  
Assessment**

**November 2006**

**State of California**

Governor, Arnold Schwarzenegger

**California Resources Agency**

Secretary, Mike Chrisman

**California Environmental Protection Agency**

Secretary, Alan Lloyd

*North Coast Watershed Assessment Program Participants*

*Contributing Agencies and Departments*

Department of Fish and Game  
Director, Loris “Ryan” Broddrick

State Water Resources Control Board  
Chair, Art Baggett

Department of Forestry and Fire Protection  
Director, Dale Gildert

North Coast Regional Water  
Quality Control Board  
Executive Officer, Catherine Kuhlman

Department of Water Resources  
Director, Lester A. Snow

Department of Conservation  
Interim Director, Debbie Sareeram

## ***Big River Assessment Team***

### **Assessment Manager**

Scott Downie

California Department of Fish and Game

### **Fisheries:**

Steve Cannata

California Department of Fish and Game

Beatrijs deWaard

Pacific States Marine Fisheries Commission

Cynthia LeDoux-Bloom

California Department of Fish and Game

### **Forestry and Land Use:**

Rob Rutland

California Department of Forestry and Fire Protection

### **Water Quality:**

Elmer Dudik

North Coast Regional Water Quality Control Board

### **Geology:**

Karin W. Fresnel

Department of Conservation/California Geological Survey

### **Fluvial Geomorphology:**

Dawn McGuire

Department of Conservation/California Geological Survey  
Currently Department of Fish and Game

### **Geographic Information System, Data Management, Ecological Management Decision System (EMDS)**

Vikki Avara-Snider – GIS & Document Production

Pacific States Marine Fisheries Commission

Kimberly Pettit - GIS

Pacific States Marine Fisheries Commission

Steve Cannata - EMDS

California Department of Fish and Game

Chris Fischer - EMDS

California Department of Forestry and Fire Protection

Kevin Hunting - GIS

California Department of Fish and Game

Chris Keithley - EMDS

California Department of Forestry and Fire Protection

Richard Walker, Ph.D. - EMDS

California Department of Forestry and Fire Protection

### **Research:**

John Richardson

Pacific States Marine Fisheries Commission

### **ACKNOWLEDGEMENTS**

The Big River Assessment Team wishes to thank the following for their shared valuable data, assistance, and time: California State Parks, Mendocino Redwood Company, Hawthorne Timber Company, the California Geological Survey, Graham Matthews and Associates, Doug Albin, Scott Monday, Scott Harris, and Dave Wright. We are also very grateful to the numerous private landowners who granted team members access to collect data.

### **Suggested Citation:**

**Downie, S., B. deWaard, E. Dudik, D. McGuire, and R. Rutland.** 2006. Big River Basin Assessment Report. North Coast Watershed Assessment Program. California Resources Agency, and California Environmental Protection Agency, Sacramento, California.

# *NCWAP Basin Assessment Products*

## **Reports**

Main products are basin level assessment reports for each subject watershed. These reports consist of an integrative synthesis report and a number of discipline-oriented appendices. A limited number of these synthesis reports and appendices were produced in printed media for program cooperators and partners, constituent groups, and agencies. Printed reports were also distributed to most major libraries. Printed documents are not currently available to the public; however, the entire synthesis report document, including appendices and maps, is available on a compact disk in PDF format or via the website

[www.coastalwatersheds.ca.gov](http://www.coastalwatersheds.ca.gov). Basin assessment reports are currently available for the Gualala, Mattole, Albion, and Big River basins. CDs containing the reports, appendices, and maps may be requested from:

California Department of Fish and Game  
Coastal Watershed Planning and Assessment Program  
1487 Sandy Prairie Court, Ste. A  
Fortuna, CA 95540  
707.725.1070

## **Klamath Resource Information System CDs and Website**

The Institute for Fisheries Resources (IFR) has produced Klamath Resource Information System (KRIS) projects for several North Coast watersheds. KRIS is a custom software program capable of managing watershed data sets, tables, charts, photos, and maps. The current KRIS products are available via the IFR website ([www.krisweb.com](http://www.krisweb.com)), or on CD from:

Department of Forestry and Fire Protection  
Fire and Resource Assessment Program  
PO Box 944246  
Sacramento, CA 94244-2460  
(916) 327-3939  
[frap@fire.ca.gov](mailto:frap@fire.ca.gov)

## **Maps of Landslides and Relative Landslide Potential**

To date, the California Geological Survey has produced maps and GIS coverage of landslides and relative landslide potential on the Mattole, Gualala, and Big rivers, and Redwood Creek basins. To order map sets contact one of the California Geological Survey offices:

Publications Sales-Sacramento  
(916) 445-6199 fax: (916)324-5644

Southern California Regional Office-Los Angeles  
(213) 239-0878

Publications and Information Office-Sacramento  
(916) 445-5716

Bay Area Regional Office-San Francisco  
(415) 904-7707

You may also download the order form from the web site:

[www.consrv.ca.gov/cgs/information/publications/ordering.htm](http://www.consrv.ca.gov/cgs/information/publications/ordering.htm)

## **Data sets and GIS Products**

A number of data sets and GIS products have been produced as a part of this work. Some of these products are available at [www.coastalwatersheds.ca.gov](http://www.coastalwatersheds.ca.gov)

# Table of Contents

<b>Program Introduction and Overview</b> .....	<b>1</b>
Assessment Needs for Salmon Recovery & Watershed Protection .....	1
Program Assessment Region .....	1
Program Guiding Questions .....	1
Program Goals .....	2
North Coast Salmon, Stream, and Watershed Issues .....	2
Factors Affecting Anadromous Salmonid Production .....	5
Disturbance and Recovery of Stream and Watershed Conditions .....	7
Natural and Human Disturbances .....	7
Defining Recovered .....	7
Factors and Rates of Recovery .....	8
Continuing Challenges to Recovery .....	8
Policies, Acts, and Listings .....	9
Federal Statutes .....	9
State Statutes .....	9
<b>Assessment Strategy and General Methods</b> .....	<b>11</b>
Basin Assessment Approach .....	11
Guiding Assessment Questions and Responses .....	12
Report Utility and Usage .....	13
Program Products .....	13
Assessment Report Conventions .....	13
Subbasins .....	13
CalWater 2.2.1 Planning Watersheds .....	14
Hydrology Hierarchy .....	16
Electronic Data Conventions .....	16
Methods by Department .....	18
Geology and Fluvial Geomorphology .....	18
Hydrology .....	19
Data Collection .....	19
Mean Discharge .....	19
Flow Duration and Annual Runoff .....	19
Peak Discharge .....	19
Flood Frequency .....	20
Water Rights .....	20
Vegetation and Land Use .....	20
Vegetation .....	20
Fire and Fuels .....	20
Population .....	21
Land Use .....	21
CDF Northern Region Forest Practice GIS Timber Harvesting Plan Data .....	22
Roads .....	22
Stream Buffer Vegetation .....	22
Disturbance .....	22
Water Quality .....	23
Water Quality Criteria .....	23
Data Analysis Methods .....	24
Channel Measurements & Sediment Sources .....	24
Water Temperature .....	26

USFWS Temperature Study.....	28
Suspended Sediment & Turbidity .....	28
Water Column Chemistry.....	28
Fish Habitat and Populations.....	29
Data Compilation and Gap Identification .....	29
Data Collection.....	29
Fish Passage Barriers .....	30
Large Woody Debris .....	31
Target Values from Habitat Inventory Surveys .....	31
Canopy Density—Eighty Percent or Greater of the Stream is Covered by Canopy.....	31
Good Spawning Substrate- Fifty Percent or Greater of the Pool Tails Sampled are Fifty Percent or Less Embedded .....	32
Pool Depth/Frequency- Forty Percent or More of the Stream Provides Pool Habitat .....	32
Shelter/Cover- Scores of One Hundred or Better Means that the Stream Provides Sufficient Shelter/Cover.....	32
MRC Watershed Analysis.....	32
Analytic Tools and Interdisciplinary Synthesis .....	33
Integrated Analysis Tables .....	33
Ecological Management Decision Support System .....	33
Development of the North Coast California EMDS Model.....	34
The Knowledge Base Network .....	34
Advantages Offered by EMDS .....	38
Limitations of the EMDS Model and Data Inputs .....	38
Management Applications of Watershed Synthesis Results.....	39
Adaptive Application for EMDS and CDFG Stream Habitat Evaluations .....	39
Limiting Factors Analysis .....	40
Restoration Needs/Tributary Recommendations Analysis .....	40
Potential Salmonid Refugia.....	41
Spatial and Temporal Scales of Refugia .....	42
Refugia and Meta-population Concept .....	43
Methods to Identify Refugia .....	43
Approach to Identifying Refugia.....	44
Salmonid Refugia Categories and Criteria:.....	45
Other Related Refugia Component Categories:.....	46
<b>Big River Basin Profile and Synthesis.....</b>	<b>49</b>
Subbasin Scale.....	50
Climate .....	53
Hydrology.....	56
Mean Daily Discharge.....	58
Flow Duration .....	58
Annual Runoff.....	58
Peak Discharge.....	60
Flood Frequency.....	61
Historic Floods .....	61
Diversions, Dams, and Power Generation .....	63
Geology .....	63
Bedrock .....	64
Coastal Belt Terrane.....	64
Central Belt Terrane .....	64
Tertiary Sandstone.....	64
Faulting, Seismicity, and Regional Uplift.....	66

Slope Classes.....	66
Sediment Source Analysis.....	68
Landsliding.....	68
Historic Analysis.....	68
Current Mapping.....	70
Landslide Potential.....	70
Fluvial Geomorphology.....	71
Channel Entrenchment.....	71
Bankfull Discharge.....	71
Alluvial Sediment Storage.....	71
Stream Gradient.....	74
Mappable Channel Features.....	74
Mainstem of the Big River.....	78
Vegetation.....	78
Fire History.....	81
Population.....	83
Ownership.....	83
Land Use.....	83
Timber Harvest.....	83
Roads.....	90
Railroads.....	93
Public Lands.....	93
Land Management.....	95
Water Quality.....	96
Water Temperature.....	96
Trends.....	96
Sediment.....	97
Water Chemistry.....	98
Riparian Conditions.....	98
Fish Habitat Relationships.....	99
Historic Conditions.....	100
Effects of Historic Splash Dams.....	101
Large Woody Debris Removal and Reduction.....	103
Current Conditions.....	104
Large Woody Debris.....	106
Fish Passage Barriers.....	106
Changes in Habitat Conditions from 1964 to 2001.....	106
Fish History and Status.....	107
Fishing Interests and Constituents.....	115
Restoration Programs.....	115
Special Status Species.....	117
Big River Basin General Issues.....	118
Integrated Analyses.....	118
Landsliding Interactions.....	118
Slope Interactions.....	120
Road Interactions.....	122
Road Crossings.....	123
Fluvial Erosion.....	123
Stream Interactions.....	123
Pool Quantity and Quality.....	124
Spawning Gravel Quality.....	124

Shade Canopy .....	125
Pool Shelter .....	125
Fish Passage .....	126
Large Woody Debris .....	126
Stream Reach Condition EMDS .....	127
Analysis of Tributary Recommendations.....	132
MRC Treatment Prescriptions.....	133
Refugia Areas .....	135
Big River Basin Tributaries by Refugia Category: .....	136
Responses to Assessment Questions .....	139
<b>Subbasin Profiles and Synthesis.....</b>	<b>144</b>
<b>Coastal Subbasin .....</b>	<b>144</b>
Climate .....	144
Hydrology.....	144
Estuary.....	147
Geology .....	148
Landsliding.....	148
Fluvial Geomorphology .....	149
Vegetation .....	153
Fire and Fuels .....	154
Land Use .....	154
Forest Management .....	156
Roads.....	158
Water Quality .....	158
Estuary.....	158
Sediment.....	158
Water Column Chemistry.....	158
Estuary Discussion .....	160
Tributaries and Mainstem.....	160
Water Temperature.....	160
Sediment.....	163
Water Column Chemistry.....	164
Discussion .....	168
Riparian Conditions.....	168
Fish Habitat Relationship .....	171
Past Conditions.....	171
Current Conditions .....	173
Habitat Inventory Surveys.....	173
Fish Passage Barriers .....	177
Stream Crossings.....	177
Dry Channel .....	178
Restoration Programs .....	179
Changes in Habitat Conditions from 1960 to 2001 .....	180
Fish History and Status .....	181
Coastal Subbasin Issues .....	183
Coastal Subbasin Integrated Analysis .....	183
Landsliding Interactions.....	183
Slope Interactions.....	186
Road Interactions.....	187
Road Crossings.....	188
Fluvial Erosion .....	189



Stream Interactions.....	189
Primary Pools .....	189
Spawning Gravel Quality .....	190
Shade Canopy.....	190
Fish Passage .....	190
Fish Passage .....	191
Pool Shelter .....	191
Large Woody Debris .....	191
Stream Reach Conditions EMDS .....	192
Analysis of Tributary Recommendations.....	193
Sediment Source Restoration Sites Within the Big River State Park .....	195
Refugia Areas .....	197
Responses to Assessment Questions .....	197
Subbasin Conclusions .....	201
<b>Middle Subbasin.....</b>	<b>202</b>
Climate .....	202
Hydrology.....	202
Geology .....	204
Landsliding.....	204
RC Ownership.....	205
Fluvial Geomorphology .....	205
Vegetation .....	206
Fire and Fuels .....	207
Land Use .....	207
Forest Management .....	207
Roads.....	209
Water Quality .....	209
Temperature .....	209
Sediment.....	212
Discussion .....	214
Riparian Conditions.....	214
Fish Habitat Relationship .....	215
Past Habitat Conditions .....	215
Current Conditions .....	216
Habitat Inventory Surveys.....	216
MRC Habitat Surveys .....	221
Canopy Closure .....	221
Pools .....	222
Fish Passage Barriers .....	224
Restoration Programs .....	225
Changes in Habitat Conditions from 1960 to 2001 .....	226
Fish History and Status .....	226
Middle Subbasin Issues .....	229
Middle Subbasin Integrated Analysis .....	230
Landsliding Interactions .....	230
Slope Interactions .....	231
Road Interactions.....	232
Road Crossings.....	234
Fluvial Erosion .....	235
Stream Interactions.....	235
Primary Pools .....	235

Spawning Gravel Quality .....	236
Shade Canopy.....	236
Fish Passage .....	237
Pool Shelter .....	237
Large Woody Debris .....	237
Stream Reach Conditions EMDS .....	238
MRC Road Hazard Map.....	239
Analysis of Tributary Recommendations.....	240
Refugia Areas.....	241
Responses to Assessment Questions.....	242
Subbasin Conclusions .....	244
<b>Inland Subbasin.....</b>	<b>246</b>
Climate .....	246
Hydrology.....	246
Geology .....	250
Landsliding.....	250
MRC Ownership .....	251
Fluvial Geomorphology .....	252
Vegetation .....	254
Fire and Fuels .....	255
Land Use .....	256
Forest Management .....	256
Roads.....	258
Water Quality .....	258
Temperature .....	259
North Fork Drainage .....	259
South Fork Drainage .....	263
Headwaters Drainage .....	265
Summary .....	267
Sediment.....	268
Turbidity and Suspended Sediment.....	268
Bulk Sediment .....	270
Permeability .....	271
Water Chemistry .....	272
Discussion .....	275
Riparian Conditions.....	276
Fish Habitat Relationship.....	278
Past Habitat Conditions.....	278
Current Conditions .....	285
Habitat Inventory Surveys.....	285
Fish Passage Barriers .....	301
Restoration Programs .....	304
Changes in Habitat Conditions from 1960 to 2001 .....	305
Fish History and Status .....	308
Inland Subbasin Issues .....	320
Inland Subbasin Integrated Analysis.....	321
Landsliding Interactions.....	321
Slope Interactions.....	325
Road Interactions.....	327
Road Crossings.....	330
Fluvial Erosion .....	331

Stream Interactions.....	331
Primary Pools .....	331
Spawning Gravel Quality .....	332
Shade Canopy.....	332
Fish Passage .....	333
Pool Shelter .....	334
Large Woody Debris .....	334
Stream Reach Conditions EMDS.....	335
Analysis of Tributary Recommendations.....	336
MRC Road Hazard Map.....	338
Refugia Areas.....	340
Responses to Assessment Questions .....	341
Subbasin Conclusions .....	345
<b>Big River Basin in the Regional Context.....</b>	<b>345</b>
Summary of Basin Conditions and Recommendations.....	345
Geology .....	345
Land Use Impacts.....	345
Water Quality .....	345
Salmonid Populations.....	346
Salmonid Habitat.....	346
Limiting Factors Analysis Conclusions .....	346
Refugia Rating.....	346
Recommendations .....	346
Propensity for Improvement.....	348
Advantages .....	348
Challenges .....	348
Conclusion.....	348
Limitations of this Assessment .....	349
<b>Appendices .....</b>	<b>351</b>
Glossary.....	351
List of Abbreviations.....	357
Bibliography.....	358
Spatial Data Availability, Catalog, Standards and Analyses .....	369
Data Availability .....	369
Spatial and Geographic Information Systems (GIS) Data Standards and Analyses .....	369

# List of Figures

Figure 1. Original NCWAP basin assessment area.....	1
Figure 2. Five-year running average of salmonids at Benbow Dam, South Fork Eel River, and mainstem Eel River above Cape Horn Dam. ....	4
Figure 3. Historical steelhead trout ladder counts at Van Arsdale Fisheries Station, mainstem Eel River, and Benbow Dam, South Fork Eel River. ....	5
Figure 4. Big River subbasins and CalWater 2.2.1 planning watersheds. ....	15
Figure 5. Hydrography hierarchy. ....	17
Figure 6. Selecting beneficial use protective numerical limits in water. ....	29
Figure 7. Tier one of the EMDS stream reach knowledge base network.....	35
Figure 8. Graphic representation of the Stream Reach Condition model. ....	36
Figure 9. EMDS reference curve for stream temperature. ....	37
Figure 10. Big River Basin, subbasins, and streams. ....	51
Figure 11. CalWater 2.2.1 planning watersheds, Big River Basin subbasins. ....	52
Figure 12. Annual precipitation and cumulative departure from the mean for the Fort Bragg precipitation gage, DWR Station # F80 3161 00, for the period 1886-1988. ....	54
Figure 13. Big River Basin precipitation and nearby precipitation and stream flow gages. ....	55
Figure 14. Annual precipitation and cumulative departure from the mean for the Willits 1 NE precipitation gage, DWR Station #F60 9685 00, for the period 1940—1999. ....	56
Figure 15. Stream order in the Big River Basin. ....	57
Figure 16. Map of 1973 USFWS study sites.....	59
Figure 17. Annual instantaneous peak discharge and 5-year moving average for South Fork Big River near Comptche, USGS station #11468070, for Water Years 1961 – 1971.....	61
Figure 18. Geology of the Big River Basin.....	65
Figure 19. Slope class identification map. ....	67
Figure 20. Map of historically active and dormant landslides across the Big River Basin (CGS 2005). .....	70
Figure 21. Area of each subbasin assigned to landslide potential categories (CGS 2005). ....	70
Figure 22. Landslide potential map for the Big River Basin (CGS 2005). ....	72
Figure 23. Inner gorges in the Big River Basin (CGS 2005). ....	73
Figure 24. Stream gradients in the Big River Basin.....	75
Figure 25. Mapped negative channel characteristics survey year 2000. ....	76
Figure 26. Mapped negative channel characteristics survey years 1984 and 2000.....	77
Figure 27. Big River Basin vegetation classes. ....	80
Figure 28. CDF recorded fires and fire hazard in the Big River Basin.....	82
Figure 29. Big River Basin land ownership. ....	84
Figure 30. Hells Gate Splash Dam on the South Fork (1912).....	85
Figure 31. Tractor arch operations. ....	87
Figure 32. Acres of timber harvest activities in the Big River Basin.....	88
Figure 33. Acres of timber harvest yarding methods in the Big River Basin. ....	89
Figure 34. Disturbance level in the Big River Basin by time period and acres. ....	90
Figure 35. Roads in the Big River Basin.....	91
Figure 36. Watercourse crossing at high risk of failing. ....	92
Figure 37. Legacy watercourse crossing removal. ....	92
Figure 38. Reclaimed landing on mainline road. ....	92
Figure 39. Abandoned road re-contoured to natural slope.....	92
Figure 40. Big River Basin railroads.....	94
Figure 41. Splash dams on the Big River, built from 1860 to 1924, used until 1936.....	102
Figure 42. Coho salmon 2002 distribution based on CDFG and MRC surveys and estimated historic distribution based on a 30 meter digital elevation model in the Big River Basin.....	111

Figure 43. Steelhead trout 2002 distribution based on CDFG and MRC surveys and estimated historic distribution based on a 30 meter digital elevation model in the Big River Basin.....	112
Figure 44. Restoration projects in the Big River Basin.....	116
Figure 50. EMDS Reach Condition model results for the Big River Basin by surveyed stream miles. .....	128
Figure 51. EMDS Reach Condition model results for the Big River Basin by percent surveyed stream miles.....	129
Figure 52. EMDS results for 1995-1998 and 2002 for canopy and pool depth.....	130
Figure 53. EMDS results for 1995-1998 and 2002 for Pool shelter and cobble embeddedness.....	131
Figure 54. The percent of recommendation categories in Big River Basin surveyed streams.....	133
Figure 55. Stream refugia in the Big River Basin.....	138
Figure 56. Drainage area of streams surveyed by CDFG in the Coastal Subbasin.....	145
Figure 57. Coastal Subbasin and CalWater2.2a planning watersheds.....	146
Figure 58. Map of salt marsh flats in the Big River Estuary in 1981 from Marcus and Reneau.....	147
Figure 59. Map showing the relatively shallow gradient (<0.1%) of the lower Big River, where sediment appears to have accumulated between photo years 1984 and 2000.....	150
Figure 60. Wonder plot experimental site.....	152
Figure 61. The ruins of Big River Mill after it burned in 1863.....	155
Figure 62. Acres of timber harvest activities in the Coastal Subbasin.....	156
Figure 63. Acres of timber harvest yarding methods in the Coastal Subbasin.....	157
Figure 64. Acres by disturbance level in the Coastal Subbasin.....	157
Figure 65. Water temperature monitoring sites, Coastal Subbasin.....	161
Figure 66. Range of MWATs, Coastal Subbasin.....	161
Figure 67. In-stream sediment and water quality monitoring sites, Coastal Subbasin.....	164
Figure 68. CDFG surveyed streams in the Coastal Subbasin.....	174
Figure 69. The relative percentage of coniferous, deciduous, and open canopy covering surveyed streams in the Coastal Subbasin.....	175
Figure 70. Cobble embeddedness categories as measured at every pool tail crest in surveyed streams in the Coastal Subbasin.....	175
Figure 71. The percentage of pool habitat, flatwater habitat, riffle habitat, dewatered channel, and culverts by survey length in the Coastal Subbasin.....	176
Figure 72. Average pool shelter ratings from CDFG stream surveys in the Coastal Subbasin.....	177
Figure 73. Dry and wetted channel and culverts reported during CDFG stream surveys in the Coastal Subbasin.....	179
Figure 74. Electrofishing results from 1993-2001 for the Little North Fork Big River.....	182
Figure 75. Delivering landslides by category, Coastal Subbasin (GMA 2001a).....	184
Figure 76. Landslide rate vs. TMDL load allocations, Coastal Subbasin (GMA).....	186
Figure 77. Surface erosion rate vs. TMDL load allocations, Coastal Subbasin (GMA 2001a).....	188
Figure 83. EMDS Reach Condition model results for the Coastal Subbasin by surveyed stream miles. .....	193
Figure 84. Recommendation categories by stream miles in the Coastal Subbasin.....	194
Figure 85. Miles of roads classified by slope position and priority ranking in Big River State Park.....	195
Figure 86. Number of watercourse crossings evaluated by watercourse class and priority ranking in Big River State Park.....	196
Figure 87. Map of roads and watercourse crossings prioritized by restoration by CGS in Big River State Park (CGS 2004).....	196
Figure 88. Middle Subbasin and CalWater 2.2a planning watersheds.....	203
Figure 89. Drainage area of streams surveyed by CDFG in the Middle Subbasin.....	204
Figure 90. Acres of timber harvest activities in the Middle Subbasin.....	208
Figure 91. Acres of timber harvest yarding methods in the Middle Subbasin.....	208
Figure 92. Acres by disturbance level in the Middle Subbasin.....	209

Figure 93. Range of MWATs, Middle Subbasin. ....	210
Figure 94. Water temperature monitoring sites, Middle Subbasin.....	211
Figure 95. In-stream sediment and water quality monitoring sites, Middle Subbasin.....	213
Figure 96. Map of LWD recruitment potential classes on MRC ownership in the Middle Subbasin (MRC 2003). ....	215
Figure 97. CDFG surveyed streams in the Middle Subbasin.....	217
Figure 98. The relative percentage of coniferous, deciduous, and open canopy covering surveyed streams in the Middle Subbasin. ....	218
Figure 99. Cobble embeddedness categories as measured at every pool tail crest in surveyed streams in the Middle Subbasin.....	219
Figure 100. The percentage of pool habitat, flatwater habitat, riffle habitat, dewatered channel, and culverts by survey length in the Middle Subbasin. ....	219
Figure 101. Average pool shelter ratings from CDFG stream surveys in the Middle Subbasin.....	220
Figure 102. Stream Canopy closure on stream segments in the MRC ownership of the Middle Subbasin (MRC 2003).....	221
Figure 103. Map of instream LWD demand in MRC ownership in the Middle Subbasin (MRC 2003). .....	224
Figure 104. Dry and wetted channel and culverts reported during CDFG stream surveys and culverts reported by MRC (2004) in the Middle Subbasin.....	225
Figure 105. Electrofishing results from 1993-2000 for Two Log Creek (surveys by Georgia-Pacific). .....	229
Figure 106. Delivering landslides by category, Middle Subbasin (GMA 2001a).....	230
Figure 107. Landslide rate vs. TMDL load allocations, Middle Subbasin (GMA). ....	231
Figure 108. Surface erosion rate vs. TMDL load allocations, Middle Subbasin (GMA). ....	233
Figure 109. Skid trail sediment delivery estimates for MRC ownership in the Middle Subbasin. ....	234
Figure 115. EMDS Reach Condition model results for the Middle Subbasin by surveyed stream miles. .....	239
Figure 116. MRC roads erosion hazard classes in the Middle Subbasin. ....	240
Figure 117. Recommendation categories by stream miles in the Middle Subbasin. ....	241
Figure 118. Inland Subbasin and CalWater 2.2a planning watersheds.....	247
Figure 119. Drainage area of streams surveyed by CDFG in the Inland Subbasin.....	250
Figure 120. Acres of timber harvest activities in the Inland Subbasin. ....	257
Figure 121. Acres of timber harvest yarding methods in the Inland Subbasin. ....	257
Figure 122. Acres by disturbance level in the Inland Subbasin. ....	258
Figure 123. Water temperature monitoring sites, Inland Subbasin.....	261
Figure 124. Range of MWATs in the North Fork drainage.....	263
Figure 125. Range of MWATs in the South Fork drainage.....	264
Figure 126. Range of MWATs in the headwaters drainage.....	267
Figure 127. In-stream sediment and water quality monitoring sites, North Fork Big River Subbasin. .....	270
Figure 128. Map of LWD recruitment potential classes on MRC ownership in the Inland Subbasin (MRC 2003). ....	278
Figure 129. CDFG surveyed streams in the Inland Subbasin. ....	287
Figure 130. The relative percentage of coniferous, deciduous, and open canopy covering surveyed streams in the Inland Subbasin.....	288
Figure 131. Cobble embeddedness categories as measured at every pool tail crest in surveyed streams in the Inland Subbasin. ....	289
Figure 132. The percentage of pool habitat, flatwater habitat, riffle habitat, dewatered channel, and culverts by survey length in the Inland Subbasin.....	290
Figure 133. Average pool shelter ratings from CDFG stream surveys in the Inland Subbasin. ....	292

Figure 134. Stream canopy closure on stream segments in the MRC ownership of the Inland Subbasin (MRC 2003). .....	295
Figure 135. Map of instream LWD demand in MRC ownership in the Inland Subbasin (MRC 2003). .....	300
Figure 136. Dry and wetted channel and culverts reported during CDFG stream surveys, and culverts. ....	303
Figure 137. Electrofishing results from 1993 and 1994 for East Branch North Fork Big River. ....	318
Figure 138. Electrofishing results from 1993 and 1994 for Gates Creek.....	319
Figure 139. Electrofishing results from 1993 and 1994 for mainstem Big River at Wild Horse Opening. ....	320
Figure 140. Delivering landslides by category, Inland Subbasin (GMA 2001a). ....	321
Figure 141. Landslide rate vs. TMDL load allocations, Inland Subbasin (GMA 2001a). ....	324
Figure 142. Sediment input rate from all shallow-seated landslides and road-associated shallow-seated landslides for the MRC ownership from 1970 to 2000. ....	325
Figure 143. Surface erosion rate vs. TMDL load allocations. ....	328
Figure 144. Skid trail sediment delivery estimates for MRC ownership in the Inland Subbasin (MRC 2003). ....	329
Figure 150. EMDS Reach Condition model results for the Inland Subbasin by surveyed stream miles. ....	336
Figure 151. Recommendation categories by stream miles in the Inland Subbasin. ....	338
Figure 152. MRC roads erosion hazard classes in the Inland Subbasin. ....	339

## List of Tables

Table 1. Comparison chart of the tree size classes. ....	20
Table 2. Criteria used in the assessment of water quality data .....	23
Table 3. Continuous water temperature data review steps. ....	26
Table 4. Definitions of barrier types and their potential impacts to salmonids. ....	30
Table 5. Target for number of key large woody debris pieces in watercourses of the MRC ownership in the Big River Basin. ....	31
Table 6. Habitat inventory target values. ....	31
Table 7. Fish habitat condition indices for measured parameters used by MRC. ....	33
Table 8. Reference curve metrics for EMDS stream reach condition model. ....	37
Table 9. List of tributary recommendations in stream tributary reports. ....	41
Table 10. Refugia rating worksheet. ....	47
Table 11. Water quality refugia rating sheet. ....	48
Table 12. Big River Basin and subbasin characteristics. ....	53
Table 13. Long-term precipitation gages near the Big River Basin. ....	54
Table 14. DWR 1965 estimates of flow required to maintain fishery resources in the Big River. ....	56
Table 15. Streamflow data collected by USFWS across the Big River Basin in 1973. ....	58
Table 16. Annual runoff and cumulative departure from mean Big River downstream of Laguna Creek. ....	60
Table 17. Mainstem Big River 3-parameter log-normal flood frequency analysis for the combined historic and synthetic 1952-2001 period of record (after GMA 2001a). ....	61
Table 18. South Fork Big River USGS gage #11468070 peak discharges and annual maximums. ....	62
Table 19. Big River data for assessing event magnitude. Data sources sorted and ranked with top 20 values listed. ....	63
Table 20. Slope classes in the Big River Basin. ....	66
Table 21. Big River Basin number of delivering landslides by type and period. ....	68

Table 22. Big River Basin number of delivering slides by study period and subbasin. ....	68
Table 23. Number and volume (in tons) of inner gorge landslides in the Big River Basin by subbasin and study period. ....	69
Table 24. Volume of delivering slides by study period by subbasin. ....	69
Table 25. Number, total volume, and average volume of slides by period.....	69
Table 26. Rate of delivering slides by study period by subbasin (tons/square mile/year for period). ...	69
Table 27. Inner gorges in the Big River Basin.....	71
Table 28. List showing number and total lengths in miles of mappable channel features in major channels, Big River Basin. ....	74
Table 29. Acreage and proportion of area of vegetation classes in subbasins. ....	79
Table 30. Acres and percentage of vegetation in different size classes in the Big River Basin by subbasin. ....	79
Table 31. Density of vegetation in the Big River Basin by subbasin.....	79
Table 32. Population and population density of the Big River Basin by subbasin. ....	83
Table 33. Timber harvest in the Big River Basin.....	89
Table 34. Truck roads in the Big River.....	90
Table 35. Acres by crown canopy density in watercourse buffer zone by subbasin.....	99
Table 36. Percentage of stream buffer area in higher canopy closure classes by subbasin. ....	99
Table 37. Acres by vegetation size class in watercourse buffer zone by subbasin. ....	99
Table 38. Anadromous habitat in the Big River Basin in 1965 (from CDFG 1965). ....	100
Table 39. Streams surveyed by CDFG in the Big River Basin from 1957-1966. ....	101
Table 40. Summary of current (1995, 1996, 1997, 1998, and 2002) conditions.....	105
Table 41. Fishery resources of Big River.....	107
Table 42. Documented salmonid presence across the Big River Basin. ....	108
Table 43. Salmonid stocking in the Big River Basin. ....	113
Table 44. Coho salmon and steelhead trout presence reported in CDFG and CEMR stream surveys from 1950-1989.....	113
Table 45. USFWS electrofishing results from ten transects across the Big River Basin in 1973.....	113
Table 46. Coho salmon and steelhead trout presence documented by NMFS (Jones2000). ....	114
Table 47. Coho salmon and steelhead trout presence reported in MRC stream surveys from 1990- 2002.....	114
Table 48. Coho salmon and steelhead trout presence reported in Georgia Pacific stream surveys in 1996.....	114
Table 49. Coho salmon and steelhead trout presence reported in CDFG stream surveys from 1990- 2003.....	115
Table 50. Special status species of the Big River Basin. ....	117
Table 51. Occurrence of delivering debris torrents and slides by land use, 1952-2000. ....	119
Table 52. Volumes of delivering slides by land use by subbasin in tons.....	120
Table 53. Volumes of delivering slides by land use by subbasin as percentage of basin total.....	120
Table 54. Acreage harvested by slope of ground, period, and method. ....	120
Table 55. Big River Basin ground disturbance by slope and harvest type, 1852-2001. ....	121
Table 56. Existing miles of roads in different road positions by types and subbasin (from GMA 2001a).....	122
Table 57. Big River Basin roads by location and surface type. ....	122
Table 58. Computed road surface erosion by study period by subbasin.....	122
Table 59. Summary of surface erosion estimates from harvest areas by study period in tons.....	123
Table 60. Length of truck roads in near proximity to watercourse. ....	123
Table 61. Bank erosion and small streamside mass wasting.....	123
Table 62. Salmonid habitat artificially obstructed for fish passage. ....	126
Table 63. Juvenile salmonid passage in the Big River Basin.....	126
Table 64. EMDS Anadromous Reach Condition Model results for the Big River Basin.....	127



Table 65. Occurrence of recommendations in first three ranks in surveyed streams.....	132
Table 66. How improvement recommendations were collapsed into recommendation categories in the Big River Basin. ....	132
Table 67. Distribution of basin wide recommendation categories in the Big River subbasins.....	132
Table 68. Causal mechanisms and action prescriptions for the MRC ownership in the Big River Basin (MRC 2003). ....	134
Table 69. Subbasin salmonid refugia area ratings in the Big River Basin.....	136
Table 70. Tributaries to the Big River in the Coastal Subbasin by river mile from 7.5 minute topographic maps. ....	145
Table 71. Coastal Subbasin number of delivering slides by study period and PW (GMA 2001a).....	148
Table 72. Volume of delivering slides by study period by PW in the Coastal Subbasin (GMA 2001a). ....	148
Table 73. Landslide Potential in the Coastal Subbasin. ....	148
Table 74. Channel reaches of different sinuosity and possible geologic/geomorphic controls within the Big River State Park (from CGS 2004). ....	151
Table 75. Channel types in surveyed streams of the Coastal Subbasin. ....	153
Table 76. Acreage and proportion of area of vegetation classes in the Coastal Subbasin. ....	153
Table 77. Vegetation size class in the Coastal Subbasin by planning watershed. ....	153
Table 78. Density of vegetation in the Coastal Subbasin by planning watershed. ....	154
Table 79. Timber harvest in the Coastal Subbasin.....	156
Table 80. Length of truck roads by period and road surface.....	158
Table 81. Basic water chemistry, Big River Estuary. ....	159
Table 82. General water column chemistry, Big River Estuary.....	159
Table 83. Water temperature summary, Coastal Subbasin. ....	162
Table 84. Turbidity summary, Coastal Subbasin. ....	163
Table 85. Bulk sediment data summary (volumetric), LNF Big River (HTC). ....	164
Table 86. Basic physical water parameters, Coastal Subbasin. ....	165
Table 87. General water column chemistry, Coastal Subbasin.....	166
Table 88. Phosphorus summary, Coastal Subbasin.....	167
Table 89. Density of riparian vegetation in the Coastal Subbasin by planning watershed. ....	168
Table 90. Percentage of stream buffer area in higher canopy closure classes in the Coastal Subbasin. ....	169
Table 91. Acres and percentage of vegetation size classes in the watercourse buffer zone in the Coastal Subbasin. ....	169
Table 92. Mendocino High School of Natural Resources estuary study plant species list for mud flat #1 (after SONAR 2002). ....	169
Table 93. Freshwater and salt marsh plant associations (from Seacat et al. 1981). ....	170
Table 94. Habitat comments from surveys conducted in the Coastal Subbasin from 1959-1979. ....	172
Table 95. Surveyed streams in the Coastal Subbasin.....	173
Table 96. Percent length of a survey composed of pools in the Coastal Subbasin. ....	176
Table 97. Mean percent of shelter cover types in pools for surveyed tributaries in the Coastal Subbasin. ....	177
Table 98. Culverts described on streams inventoried by CDFG in the Coastal Subbasin. ....	178
Table 99. CGS evaluated watercourse crossings of Class I streams in Big River State Park (CGS 2004).....	178
Table 100. Dry channel recorded in CDFG stream surveys in the Coastal Subbasin.....	179
Table 101. Restoration projects in the Coastal Subbasin. ....	179
Table 102. Comparison between historic habitat conditions with current habitat inventory surveys in the Coastal Subbasin. ....	180
Table 103. Summary of all electrofishing, snorkel survey, carcass survey, and bank observation surveys conducted in the Coastal Subbasin.....	181

Table 104. Volumes of delivering slides by land use by PW for 1937-2000 in the Coastal.....	184
Table 105. Volume of delivering slides by land use, PW, and year in the Coastal Subbasin.....	185
Table 106. Length of truck roads by side slope and road surface.....	186
Table 107. Coastal Subbasin roads by location and surface type.....	186
Table 108. Existing miles of road in different road positions by types and PW in the Coastal Subbasin (from GMA 2001a). .....	187
Table 109. Computed road surface erosion by study period by PW in the Coastal Subbasin (GMA 2001a).....	187
Table 110. Summary of surface erosion estimates from harvest areas by study period in the Coastal Subbasin (GMA 2001a). .....	187
Table 111. Length of truck roads in near proximity to watercourse in miles by watercourse classification and road classification in the Coastal Subbasin. ....	188
Table 112. Length of truck roads in near proximity to watercourse in miles by period of construction and road classification in the Coastal Subbasin. ....	188
Table 113. Number of watercourse truck road crossings by watercourse and road classification in the Coastal Subbasin. ....	188
Table 114. Bank erosion and small streamside mass wasting in the Coastal Subbasin.....	189
Table 115. Juvenile salmonid passage in the Coastal Subbasin.....	191
Table 116. EMDS Anadromous Reach Condition Model results for the Coastal Subbasin.....	192
Table 117. Ranked tributary recommendations summary in the Coastal Subbasin based on CDFG stream inventories. ....	194
Table 118. Top three ranking recommendation categories by number of tributaries in the Coastal Subbasin. ....	194
Table 119. Tributary salmonid refugia area ratings in the Coastal Subbasin.....	197
Table 120. Tributaries to the Big River in the Middle Subbasin by river mile from 7.5 minute topographic maps. ....	204
Table 121. Middle Subbasin number of delivering slides by study period and PW (GMA 2001a). ...	205
Table 122. Volume of delivering slides by study period by PW in the Middle Subbasin (GMA 2001a). .....	205
Table 123. Landslide Potential in the Middle Subbasin.....	205
Table 124. Shallow-seated landslide summary for lands under MRC ownership in the Middle Subbasin. ....	205
Table 125. Percent of landslides by type and PW for lands under MRC ownership in the Middle Subbasin. ....	205
Table 126. Channel types in surveyed streams of the Middle Subbasin.....	206
Table 127. Channel Types in streams surveyed by the MRC on their ownership in the Middle Subbasin. ....	206
Table 128. Acreage and proportion of area of vegetation classes in the Middle Subbasin.....	206
Table 129. Vegetation size class in the Middle Subbasin. ....	206
Table 130. Density of vegetation in the Middle Subbasin. ....	207
Table 131. Timber harvest in the Middle Subbasin. ....	207
Table 132. Length of truck roads by period and road surface.....	209
Table 133. Water temperature summary, Middle Subbasin.....	212
Table 134. Bulk sediment data summary (volumetric), Two Log Creek (HTC). ....	213
Table 135. Density of riparian vegetation in the Middle Subbasin by planning watershed. ....	214
Table 136. Percentage of stream buffer area in higher canopy closure classes in the Middle Subbasin. .....	214
Table 137. Acres by vegetation size class in watercourse buffer zone in the Middle Subbasin.....	214
Table 138. Habitat comments from surveys conducted in the Middle Subbasin from 1950-1966.....	216
Table 139. Surveyed streams in the Middle Subbasin. ....	217

Table 140. Percent length of a survey composed of pools in the Middle Subbasin. Streams are listed in descending order by drainage area. ....	220
Table 141. Mean percent of shelter cover types in pools for surveyed tributaries in the Middle Subbasin. Streams are listed in descending order by drainage area. ....	221
Table 142. Surveyed stream segments on MRC ownership in the Middle Subbasin (MRC 2003). ....	221
Table 143. Pool characteristics measured on stream segments in the MRC ownership of the Middle Subbasin (MRC 2003). ....	222
Table 144. Spawning gravel characteristics measured on stream segments in the MRC ownership of the Middle Subbasin. ....	222
Table 145. MRC LWD survey results in the Middle Subbasin (MC 2003). ....	223
Table 146. Instream LWD quality ratings for major streams and sections of streams in MRC ownership in the Middle Subbasin. ....	223
Table 147. Dry channel recorded in CDFG stream surveys in the Middle Subbasin. ....	225
Table 148. Comparison between historic habitat conditions with current habitat inventory surveys in the Middle Subbasin. ....	226
Table 149. Summary of all electrofishing, snorkel survey, and bank observation surveys conducted in the Middle Subbasin. ....	227
Table 150. Volumes of delivering slides by land use by PW for entire study period in the Middle Subbasin in tons and percentage of subbasin total (GMA 2001a). ....	230
Table 151. Volume of delivering slides by land use, PW, and year in the Middle Subbasin in tons. ....	230
Table 152. Length of truck roads by side slope and road surface. ....	232
Table 153. Middle Subbasin roads by location and surface type. ....	232
Table 154. Surface and point source erosion estimates by slope class for MRC ownership in the Middle Subbasin. ....	232
Table 155. Computed road surface erosion by study period by PW in the Middle Subbasin. ....	233
Table 156. Summary of total surface erosion estimates in tons from harvest areas by study period. ....	233
Table 157. Road associated surface and point source erosion estimates for MRC ownership in the Middle Subbasin. ....	233
Table 158. Skid trail use in acres for MRC ownership in the Middle Subbasin. ....	234
Table 159. Estimated sediment inputs by input type for the MRC ownership. ....	234
Table 160. Length of truck roads in near proximity to watercourse by watercourse classification and road classification. ....	234
Table 161. Length of truck roads in near proximity to watercourse by period of construction and road classification. ....	235
Table 162. Number of watercourse truck road crossings by watercourse and road classification in the Middle Subbasin. ....	235
Table 163. Bank erosion and small streamside mass wasting. ....	235
Table 164. Juvenile salmonid passage in the Middle Subbasin. ....	237
Table 165. EMDS Anadromous Reach Condition Model results for the Middle Subbasin. ....	238
Table 166. Ranked tributary recommendations summary in the Middle Subbasin based on CDFG Stream Inventories. ....	240
Table 167. Top Three ranking recommendation categories by number of tributaries in the Middle Subbasin. ....	241
Table 168. Tributary Salmonid Refugia Area Ratings in the Middle Subbasin. ....	242
Table 169. Tributaries to the Big River in the Inland Subbasin by river mile from 7.5 minute topographic maps. ....	248
Table 170. Inland Subbasin number of delivering slides by study period and PW. ....	251
Table 171. Volume of delivering slides by study period by PW in the Inland Subbasin. ....	251
Table 172. Landslide Potential in the Inland Subbasin. ....	251
Table 173. Shallow-seated landslide summary for lands under MRC ownership in the Inland Subbasin. ....	252

Table 174. Percent of landslides by type and PW for lands under MRC ownership in the Inland Subbasin. ....	252
Table 175. Channel types in surveyed streams of the Inland Subbasin. ....	253
Table 176. Channel types in streams surveyed by the MRC on their ownership in the Inland Subbasin. ....	254
Table 177. Acreage and proportion of area of vegetation classes in the Inland Subbasin. ....	255
Table 178. Vegetation size classes in the Inland Subbasin by planning watershed. ....	255
Table 179. Density of vegetation in the Inland Subbasin by planning watershed. ....	255
Table 180. Timber harvest in the Inland Subbasin. ....	256
Table 181. Length of truck roads in the Inland Subbasin by period and road surface. ....	258
Table 182. Water temperature summary, Inland Subbasin. ....	267
Table 183. Turbidity samples in the Inland Subbasin. ....	269
Table 184. Turbidity summary, Chamberlain Creek, North Fork Big River, and South Fork Big River (DHS and SWAMP). ....	269
Table 185. Basic physical water parameters, Inland Subbasin. ....	272
Table 186. General water column chemistry, Inland Subbasin. ....	273
Table 187. Phosphorus summary, Inland Subbasin. ....	275
Table 188. Density of riparian vegetation in the North Fork Subbasin by planning watershed. ....	276
Table 189. Percentage of stream buffer area in higher canopy closure classes in the North Fork Subbasin. ....	277
Table 190. Acres by vegetation size class in watercourse buffer zone in the Inland Subbasin. ....	277
Table 191. Habitat comments from surveys conducted in the North Fork Subbasin from 1958-1979. ....	280
Table 192. Surveyed streams in the Inland Subbasin. ....	285
Table 193. Percent length of a survey composed of pools in the Inland Subbasin. ....	291
Table 194. Mean percent of shelter cover types in pools for surveyed tributaries in the Inland Subbasin. ....	293
Table 195. Surveyed stream segments on MRC ownership in the Inland Subbasin (MRC 2003). ....	294
Table 196. Pool characteristics measured on stream segments in the MRC ownership of the Inland Subbasin (MRC 2003). ....	296
Table 197. Spawning gravel characteristics measured on stream segments in the MRC ownership of the Inland Subbasin (MRC 2003). ....	298
Table 198. MRC LWD survey results in the Inland Subbasin (MC 2003). ....	299
Table 199. Instream LWD quality ratings for major streams and sections of streams in MRC ownership in the Inland Subbasin. ....	300
Table 200. Culverts surveyed for barrier status in the Inland Subbasin (Taylor 2001). ....	301
Table 201. Culverts described on streams inventoried by CDFG and in the MRC Watershed Analysis (2003) in the Inland Subbasin. ....	302
Table 202. Dry channel recorded in CDFG stream surveys in the Inland Subbasin. ....	302
Table 203. Restoration projects in the Inland Subbasin. ....	304
Table 204. Comparison between historic habitat conditions with current habitat inventory surveys in the North Fork Subbasin. ....	306
Table 205. Summary of all electrofishing, snorkel survey, and bank observation surveys conducted in the Inland Subbasin. ....	309
Table 206. Volumes of delivering slides by land use by PW for entire study period. ....	322
Table 207. Volume of delivering slides by land use, PW, and year (in tons). ....	323
Table 208. Percent of road-associated landslides by PW for lands under MRC ownership. ....	324
Table 209. Length of truck roads by side slope and road surface in the Inland Subbasin. ....	325
Table 210. Inland Subbasin roads by location and surface type. ....	326
Table 211. Existing miles of road in different road positions by types and PW. ....	326

Table 212. Contributing road area, proportion estimates, and surface and point source erosion estimates by slope class and PWs for MRC ownership in the Inland Subbasin. ....	327
Table 213. Computed road surface erosion by study period by PW.....	327
Table 214. Summary of surface erosion estimates from harvest areas by study period in the Inland Subbasin. ....	328
Table 215. Road associated surface and point source erosion estimates by PW for MRC ownership. ....	329
Table 216. Skid trail use in acres for MRC ownership in the Inland Subbasin (MRC 2003).....	329
Table 217. Estimated sediment inputs by input type for the MRC ownership averaged over 30 years, 1970-2000.....	330
Table 218. Length of truck roads in near proximity to watercourse in miles by watercourse classification and road classification. ....	330
Table 219. Length of truck roads in near proximity to watercourse in miles by period of construction and road classification. ....	330
Table 220. Number of watercourse truck road crossings by watercourse and road classification.....	330
Table 221. Bank erosion and small streamside mass wasting in the Inland Subbasin.....	331
Table 222. Salmonid habitat artificially obstructed for fish passage (N=3 Culverts).....	333
Table 223. Juvenile salmonid passage in the Inland Subbasin (1993-2002 CDFG Stream Surveys, CDFG Appendix). ....	333
Table 224. EMDS Anadromous Reach Condition Model results for the Inland Subbasin.....	335
Table 225. Ranked tributary recommendations summary in the Inland Subbasin based on CDFG stream inventories. ....	337
Table 226. Top three ranking recommendation categories by number of tributaries in the Inland Subbasin. ....	338
Table 227. Select high treatment immediacy road sites within MRC ownership. ....	339
Table 228. Tributary Salmonid Refugia Area Ratings in the North Fork Subbasin. ....	340