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Economic Analysis of Critical Habitat Designation for Three Populations of Bull Trout

Coastal-Puget Sound
Jarbidge River
Saint Mary-Belly River

Prepared for:

U.S. Fish and Wildlife Service
Division of Economics
Alexandria, Virginia

Prepared by:

Northwest Economic Associates
A Division of ENTRIX, Inc.
Vancouver, Washington

June 14, 2005

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June 14, 2005

Since the completion of the Draft Economic Analysis (DEA) in May 2005, new information has become available, provided through the public comment period. This new information submitted by the City of Seattle, indicates that the estimated costs associated with the Tolt Hydroelectric Project should not be included in this economic analysis.

The DEA estimates economic impacts to the Tolt Project based on a projected need for fish screens at some point in the future, as described in Section 3.4.1.1 of the DEA. The stream segment on which the Tolt Project and reservoir are located, however, is not within the boundaries of the proposed critical habitat designation (CHD) for the bull trout; the proposed CHD stream reaches include a stretch of the Lower Snoqualmie River a few miles below the Tolt Project. The DEA estimates impacts of bull trout conservation efforts at the watershed level although it acknowledges that, in some cases, only a fraction of the stream segments within a watershed are actually proposed for CHD. As described in Section 2.1 of the DEA, the geographic scale of the DEA is therefore broader than that of the proposed CHD in particular watersheds, and economic impacts in those watersheds are likely to be overstated. The commenter highlights that, as bull trout are not present at this site, assigning economic impacts at the site as relevant to bull trout conservation is inaccurate. The revision to the economic analysis in this Author's Note acknowledges the resulting overstatement of economic impacts within this watershed. Removal of the fish screen-related costs associated with the Tolt Project from the economic impacts as estimated in the DEA reduces the total prospective costs within the Lower Snoqualmie River HUC from $195,300 to $173,000, and the prospective costs of the entire proposed CHD from $679.3 million to $679.0 million.

Executive Summary ES-1

1.0 Introduction and Background 1

1.1 Approach to Estimating Economic Effects ... 2
1.1.1 Efficiency Effects ... 2
1.1.2 Distributional Effects and Regional Economic Impacts ... 3
1.1.2.1 Impacts on Small Entities and Energy Supply, Distribution, and Use ... 4
1.1.2.2 Regional Economic Impacts ... 4
1.2 Scope of the Analysis ... 5
1.2.1 Sections of the Act Relevant to Economic Analysis ... 7
1.2.2 Other Relevant Protection Efforts ... 9
1.2.3 Additional Analytic Considerations ... 9
1.2.4 Benefits ... 10
1.2.4.1 The Potential for Amenity Values ... 11
1.2.5 Analytic Time Frame ... 12
1.3 Information Sources ... 12
1.4 Background of the Bull Trout Listing ... 12
1.5 Background of the Bull Trout Critical Habitat Designation ... 13
1.6 Description of the Species and Habitat ... 14
1.7 Proposed Critical Habitat Designations ... 18
1.7.1 Coastal-Puget Sound (Units 27 and 28) ... 18
1.7.2 Jarbidge River (Unit 26) ... 19
1.7.3 Saint Mary–Belly River (Unit 29) ... 19
1.7.4 A Note About Critical Habitat and Effects ... 19
1.8 Organization of the Report ... 20
1.8.1 Categories of Costs Delineated ... 21

2.0 Framework for Economic Analysis 22

2.1 Geographic Units of Designation and Economic Analysis ... 22
2.2 Retrospective and Prospective Effects ... 23
2.2.1 Nearshore Marine Habitat HUCs ... 24
2.3 General Categories of Economic Effects ... 24
2.3.1 Federal ... 24
2.3.1.1 Section 7 Consultations, Technical Assistance, and Project Modifications ... 25

2.3.2 Private ... 25
2.3.2.1 Framework for Residential and Commercial Development Effects ... 25
2.3.2.2 Framework for Effects on Forest Management Practices ... 29
2.3.2.3 Framework for Effects on Agriculture ... 29
2.3.2.4 Framework for Effects on Livestock Grazing ... 30
2.3.2.5 Framework for Effects on Mining ... 30
2.3.2.6 Framework for Effects on Transportation Networks ... 31
2.3.2.7 Framework for Effects on Dredging, Utilities, and Instream Activities ... 31
2.3.3 Secondary and Regional Impacts ... 32
2.3.4 Effects on Small Entities ... 32
2.3.5 Effects on Energy Supply ... 33
2.4 Project Life, Period of Analysis, and Discount Rate ... 33
2.5 Caveats and Assumptions ... 34
2.5.1 Coastal-Puget Sound: Distribution of Economic Effects among Listed Species ... 35
2.6 Economic Analysis of Bull Trout I: A Comparison of Approaches ... 36
3.0 Coastal-Puget Sound Population of Bull Trout 40
3.1 Socioeconomic Profile of the Critical Habitat Area ... 40
3.1.1 Location and Geography of the Coastal-Puget Sound Region ... 40
3.1.2 Population Characteristics and Demographics ... 41
3.1.3 Employment ... 42
3.1.4 Tribes in the Coastal-Puget Sound Region ... 50
3.1.4.1 Reservation Descriptions and Socioeconomic Characteristics ... 52
3.2 Regulatory Environment ... 57
3.2.1 Other Species Listed under the Act ... 57
3.2.1.1 Implications for Estimating Costs Attributable to the Bull Trout ... 59
3.2.2 Federal and State Statutes and Regulations ... 60
3.2.2.1 Northwest Forest Plan ... 60
3.2.2.2 Habitat Conservation Plans ... 61
3.2.2.3 Clean Water Act ... 66
3.2.2.4 Growth Management Act ... 67
3.2.3 Elements of the Recovery Plan ... 75
3.3 Effects on Residential and Commercial Development ... 77
3.3.1 Data and Assumptions ... 77
3.3.1.1 Development Projection ... 77

3.3.1.2 Attributing Development Costs to Stormwater Management and the Act 78
3.3.2 Costs of Project Modifications and Improvements 82
3.3.3 An Alternate Approach: Stormwater Permits and Development 83
3.4 Effects on Hydroelectric Projects and Other Water Storage Dams 84
3.4.1 Effects on Hydroelectric Projects 86
3.4.1.1 Hydroelectric Projects in the Coastal-Puget Sound Region 86
3.4.2 Assumptions and Uncertainties 100
3.4.3 Effects on Non-Hydroelectric Projects 101
3.4.3.1 Non-Hydroelectric Projects in the Coastal-Puget Sound Region 102
3.4.4 Assumptions and Uncertainties 106
3.5 Effects on Forest Management Practices and Timber Harvesting 107
3.5.1 Fish-Related Conservation Activities 109
3.5.2 Cost Estimation Methodology 109
3.5.3 Data Sources 110
3.5.4 Effects on USFS Land Management 111
3.5.5 Effects on Private Non-HCP Lands 115
3.5.5.1 Economic Effects Associated with Reduced Timber Harvest 115
3.5.5.2 Estimating Economic Effects 116
3.5.5.3 Summary Results: Potential Effects on Private Non-HCP Lands 119
3.5.6 Effects on HCP Lands 119
3.5.6.1 Cost Estimation Methodology – Private HCP Timber Lands 121
3.5.6.2 Cost Estimation Methodology – City Utility Lands 124
3.5.6.3 Cost Estimation Methodology – State DNR Lands 126
3.5.6.4 Summary Results: Potential Effects on HCP Lands 128
3.5.7 Summary of Effects Related to Forest Management Practices and Timber Harvesting 129
3.5.8 Key Assumptions Related to Forest Management Practices and Timber Harvesting . 130
3.5.9 Regional Economic Impacts 132
3.5.9.1 Forward and Backward Linkages 134
3.5.9.2 Regional Economic Impacts of Reduced Timber Harvests 134
3.6 Effects on Road Maintenance and Transportation 139
3.6.1 Data Sources 140
3.6.2 Cost Estimation Methodology 140
3.6.2.1 Estimating Total Project Costs 143
3.6.2.2 Summary of Potential Economic Impacts Associated with Transportation Projects 144

3.6.3 Assumptions and Uncertainties 145
3.7 Effects on Agriculture and Grazing 145
3.8 Effects on Commercial and Recreational Mining Operations 149
3.8.1 Introduction 149
3.8.2 Background 150
3.8.3 Analysis 151
3.8.4 Assumptions and Uncertainties 155
3.9 Effects on Recreation 155
3.9.1 Recreation Environment 156
3.9.1.1 North Cascades National Park 156
3.9.1.2 Olympic National Park 157
3.9.1.3 Mount Rainier National Park 158
3.9.1.4 Olympic National Forest 159
3.9.1.5 Mount Baker-Snoqualmie National Forest 159
3.9.2 Recreation Visitation 160
3.9.2.1 North Cascades, Olympic, Mount Rainier National Parks (NPS) 160
3.9.2.2 Olympic and Mount Baker-Snoqualmie National Forests (USFS) 161
3.9.3 Data Sources 162
3.9.4 Results and Analysis 162
3.10 Effects on Utilities 163
3.10.1 Data Sources 163
3.10.2 Cost Estimation Methodology 164
3.10.3 Assumptions and Uncertainties 166
3.11 Effects on Dredging Activities 166
3.11.1 Data Sources 167
3.11.2 Cost Estimation Methodology 167
3.11.3 Assumptions and Uncertainties 169
3.12 Effects on Instream Activities 170
3.12.1 Data Sources 170
3.12.2 Cost Estimation Methodology 171
3.12.3 Assumptions and Uncertainties 173
3.13 Effects on Culvert Replacement 173
3.13.1 Data Sources 174
3.13.2 Cost Estimation Methodology 175

3.13.2.1 Cost of Future Culvert Replacements ... 175
3.13.2.2 Cost of Past Culvert Replacements ... 178
3.13.3 Results ... 180
3.13.4 Assumptions and Uncertainties ... 180
3.14 Effects on NPDES-Permitted Facilities ... 181
3.15 Effects from Habitat Conservation Plans Under Development ... 182
3.15.1 City of Kent ... 182
3.15.2 Dungeness Conservation and Irrigation District Management Plan ... 183
3.15.3 King County *W*astewater Treatment Division HCP ... 184
3.15.4 Washington Department of Natural Resources Aquatic Lands ... 186
3.15.5 Washington State Forest Practice Rules HCP ... 187
3.15.6 Summary of HCPs Under Development ... 187
3.16 Administrative Costs of Consultation ... 188
3.16.1 Section 7 Consultations ... 188
3.17 Potential Effects on Tribal Entities ... 191
3.18 Potential Effects on Small Entities ... 194
3.19 Potential Effects on Energy Supply ... 194
3.20 Summary and Analysis of Effects in the Coastal-Puget Sound Region ... 194
3.20.1 Summary of Findings ... 194
3.20.2 Discussion of Results by CHSU ... 196
3.20.3 Discussion of Results by Watershed ... 200
4.0 Jarbidge River Population of Bull Trout 203
4.1 Socioeconomic Profile of the Critical Habitat Area ... 203
4.1.1 Location and Geography of the Jarbidge River Region ... 203
4.1.2 Population Characteristics and Demographics ... 203
4.1.3 Employment ... 204
4.1.4 Tribes in the Jarbidge River Region ... 207
4.2 Regulatory Environment ... 207
4.2.1 Other Species Listed under the Act ... 207
4.2.2 Federal and State Statutes and Regulations ... 207
4.2.2.1 INFISH (Inland Native Fish Strategy) ... 207
4.2.2.2 The Wilderness Act ... 208
4.2.3 Elements of the Recovery Plan ... 208
4.3 Effects on Road Maintenance and Transportation ... 210

4.3.1 Baseline Conditions for Road Use 210
4.3.2 Effects on Road Building Activities 211
4.4 Effects on Agriculture and Grazing 213
4.5 Effects on Commercial and Recreational Mining Operations 219
4.6 Effects on Recreational Visitation 220
4.6.1 Data Collection 220
4.6.2 Jarbidge River Area Recreation Baseline Conditions 220
4.6.2.1 Visitation Data 222
4.6.2.2 Hunting and Fishing 222
4.6.3 Results and Analysis 224
4.7 Effects on Federal and State Agencies 226
4.8 Potential Effects on Small Entities 227
4.9 Potential Effects on Energy Supply 227
4.10 Summary and Analysis of Effects in the Jarbidge River Region 226
5.0 Saint Mary-Belly River Population of Bull Trout 229
5.1 Socioeconomic Profile of the Critical Habitat Area 229
5.1.1 Location and Geography of the Saint Mary-Belly River Region 229
5.1.2 Population Characteristics and Demographics 229
5.1.3 Employment 231
5.1.4 Tribes in the Saint Mary-Belly River Region 234
5.2 Regulatory Environment 236
5.2.1 Other Species Listed under the Act 236
5.2.2 Federal and State Statutes and Regulations 236
5.2.2.1 Montana Bull Trout Restoration Team 236
5.2.3 Elements of the Recovery Plan 236
5.3 Effects on Agriculture and Grazing 238
5.3.1 Overview of the USBR Saint Mary-Milk River Project 239
5.3.1.1 The Milk River Project 240
5.3.1.2 Saint Mary Diversion and Canal 240
5.3.1.3 Fresno Reservoir 241
5.3.2 Project Modifications for Recovery 242
5.3.3 Economic Effects on Agriculture from Reduced Water Supply 245
5.3.4 Regional Economic Impacts of Milk River Project Water Supply Reductions 247
5.4 Effects on Mining Operations 247

5.5 Effects on Recreational Visitation 248
5.6 Effects on Road Maintenance and Transportation 248
5.7 Administrative Costs of Consultation 248
5.8 Summary of Effects on the Belly River 249
5.9 Potential Effects on Tribal Activities 249
5.9.1 Blackfeet Indian Reservation 250
5.9.2 Fort Belknap Indian Reservation 251
5.10 Potential Effects on Small Entities and Energy Supply 251
5.11 Summary and Analysis of Effects in the Saint Mary–Belly River Region 252

References REF-1

Appendix A: Economic Effects to Small Entities and Energy A-1

Appendix B: Issues in the Assessment of Development Costs B-1

Appendix C: Detailed Estimates of Economic Effects by HUC in Coastal-Puget Sound C-1

Appendix D: Detailed Estimates of Economic Effects by HUC in Jarbidge River D-1

Appendix E: List of Acronyms E-1

Map 1. Proposed Bull Trout Critical Habitat – Coastal-Puget Sound (23 Subunits) Olympic Peninsula (Unit 27) and Puget Sound (Unit 28)

Map 2. Proposed Bull Trout Critical Habitat – Coastal-Puget Sound Boundaries for Economic Analysis (Fifth-Field Hydrologic Unit Code (HUC) Watersheds)

Map 3. Proposed Bull Trout Critical Habitat – Jarbidge River (Unit 26)

Map 4. Proposed Bull Trout Critical Habitat – Saint Mary-Belly River (Unit 29)

Map 5. Nearshore Marine Habitat HUCs – Coastal-Puget Sound (Units 27, 28)

Map 6. Land Ownership – Coastal-Puget Sound (Units 27, 28)

Map 7. Land Ownership – Jarbidge River (Unit 26)

Map 8. Land Ownership – Saint Mary-Belly River (Unit 29)

Map 9. Overlapping Critical Habitat: Salmon and Bull Trout

Map 10. Comparison of Future Development Projections: Future Population-Based Projection and Historic Stormwater Permits – Coastal-Puget Sound (Units 27, 28)

Map 11. Timber Lands by Ownership – Coastal-Puget Sound (Units 27, 28)

Map 12. HCP Lands – Coastal-Puget Sound (Units 27, 28)

Map 13. Annual Economic Effects Associated with Co-Extensive Salmon and Bull Trout Conservation Activities by 5th Field HUC– Coastal-Puget Sound (Units 27, 28)

Map 14. Total Estimated Economic Effects by 5th Field HUC – Jarbidge River (Unit 26)

INTRODUCTION, PURPOSE, AND SCOPE

This report addresses the economic effects associated with the proposed designation of critical habitat for three populations of bull trout (*Salvelinus confluentus*): Coastal-Puget Sound, Jarbidge River, and Saint Mary-Belly River. The U.S. Fish and Wildlife Service (hereafter "Service") has released a proposed critical habitat designation (CHD) for the three populations of bull trout.[1] The purpose of this report is to identify and estimate the economic effects associated with the proposed designation of critical habitat for the Coastal-Puget Sound, Jarbidge River, and Saint Mary-Belly River populations of bull trout. The analysis attempts to quantify the economic effects associated with the proposed CHD by taking into account the cost of conservation-related measures that are likely to be associated with future economic activities that may adversely affect the habitat within the proposed boundaries. Economic costs are measured here in terms of the impacts of the listing and the CHD on the efficient use of society's resources, as well as how those costs are distributed across segments of society. This analysis is intended to assist the Secretary in determining whether the benefits of excluding particular areas from the final designation outweigh the biological benefits of including those areas in the final designation. This analysis is consistent with the designation as described in the proposed rule. As such, this analysis does not reflect potential changes to the proposed CHD in the final rule. Description of the habitat designation in the final rule may consequently differ from that presented in this analysis.

The three populations of bull trout were proposed for listing by the Service under the Endangered Species Act (Act) as "threatened" on June 10, 1998.[2] The final listing rule was published in the November 1, 1999, edition of the Federal Register,[3] along with the intent to prepare a proposed rule under Section 4(d) of the Act, or the issuance of regulations designed to conserve the species.

SCOPE OF THE ANALYSIS

The bull trout critical habitat economic analysis applies a distinct analytic framework, as outlined in Section 1.2. Among them are the following important elements:

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1 U.S. Fish and Wildlife Service, June 25, 2004, "Proposed Designation of Critical Habitat for the Jarbidge River, Coastal-Puget Sound, and Saint Mary-Belly River Populations of Bull Trout, Proposed Rule," *Federal Register*, Vol. 69, No. 122, pp. 35768-35857.

2 U.S. Fish and Wildlife Service, June 10, 1998, "Proposal to List the Coastal-Puget Sound, Jarbidge River and St. Mary-Belly River Population Segments of Bull Trout as Threatened Species, Proposed Rule," *Federal Register*, Vol. 63, No. 111, pp. 31693-31710.

3 U.S. Fish and Wildlife, November 1, 1999, "Determination of Threatened Status for Bull Trout in the Coterminous United States, Final Rule," *Federal Register*, Vol. 64, No. 210, pp. 58910-58933.

1. Consistent with recent court rulings, the analysis includes impacts that occur co-extensively with the listing under the Act. Enforcement actions taken in response to violations of the Act are not included.

2. The analysis considers conservation and protection activities for the bull trout. No distinction is made between impacts that occur due to listing and those that result from CHD. It also includes activities occurring at the State or local level that are the result of either the listing or CHD.

3. Inevitably, actions taken to protect bull trout provide benefits to other species. Where possible, this analysis addresses this issue by (1) focusing on the costs of fish-related conservation activities rather than general habitat improvements; (2) excluding activities implemented prior to the bull trout listing; and (3) excluding activities designed specifically for salmon in the Coastal-Puget Sound. Finally, when conservation activities are implemented in areas of habitat overlap between listed salmon and bull trout, the analysis includes the full costs of the fish-related conservation activities as co-extensive with salmon and bull trout.

4. Both retrospective and prospective costs are considered. Retrospective costs include those that have accrued since the time that the bull trout listing was proposed (1998), but prior to designation of critical habitat. Prospective effects include likely future costs associated with the bull trout conservation activities from the time of final CHD in 2005 to 2024.[4]

5. The geographic scope of the analysis reflects the distinct areas inhabited by the three populations of bull trout that are the subject of this analysis: the Olympic Peninsula, Puget Sound, and portions west of the Cascade Mountains of Washington; the Jarbidge River basin in northern Nevada and southern Idaho; and the Saint Mary and Belly River basins in northern Montana.

6. The geographic unit of analysis in all proposed critical habitat units is the fifth-field Hydrologic Unit Code (HUC), as defined by the U.S. Geological Survey, which correspond to watersheds.[5] The analysis focuses on economic activities occurring within fifth-field HUCs that contain stream reaches included in the proposed CHD (see Maps 1, 2, and 3 in the Map Attachment).

7. The Service proposes to exclude from CHD certain lands already covered by existing management plans (e.g., private forestry lands covered by Washington Forest Practice Rules, some tribal lands, and some Department of Defense lands) and excludes from CHD lands covered by existing Habitat Conservation Plans based on the belief that including these lands will provide

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4 In the case of hydroelectric and non-hydroelectric projects, some capital costs are spread over 50 years. This is discussed in Section 3.4 "Effects on Hydroelectric Projects and Other Water Storage Dams."

5 Throughout the remainder of the document, the terms "HUC" and "watershed" are used interchangeably.

little additional benefit to the species.[6] Other lands are proposed for critical habitat. This analysis estimates economic effects on these three types of lands and reports costs in three separate categories.

8. The localized economic efficiency effects reflect the aquatic reaches proposed as critical habitat. However, activities occurring in adjacent land or beyond the boundaries of the proposed critical habitat with the potential to affect critical habitat, such as stream water quality, are also considered when appropriate.

9. This analysis utilizes a "with" and "without" framework, and emphasizes those effects that are determined to be attributable to bull trout conservation activities. Impacts that would have occurred without the bull trout listing and CHD are evaluated on a case-by-case basis to determine if they should be assigned, in part, to conservation activities for the bull trout.

10. The period of analysis and discounting is guided by the availability of information concerning the start date and duration of the activity. Each potential cost component is examined over the time period that is appropriate for that specific activity or investment. Some of these costs are incurred one time only, while others are recurring. These costs are presented both as net present values and annualized costs, using seven and three percent discount rates.

PROPOSED CRITICAL HABITAT

The proposed CHD for the Coastal-Puget Sound population of bull trout is comprised of two units: the Olympic Peninsula River Basins (Unit 27) and the Puget Sound River Basins (Unit 28). The proposed critical habitat includes a total of approximately 2,290 miles (3,685 km) of streams, 52,540 acres (21,262 ha) of lakes, and marine areas paralleling 985 miles (1,585 km) of marine shoreline in Washington. Areas proposed for exclusion from the CHD include lands covered by four Habitat Conservation Plans (HCPs), those lands covered by the Washington State Forest Practices Rules and Regulations, and lands on the Quinault Indian Reservation managed under the Tribe's Forest Management Plan. More than half of the land encompassing the proposed critical habitat is privately owned.

The proposed CHD for the Jarbidge River population includes a total of 131 miles (211 km) of streams in Nevada and Idaho. These streams include the Jarbidge River and many of its headwater tributaries. These stream segments provide either foraging, migration, and overwintering (FMO) habitat, or provide spawning and rearing habitat. More than 90 percent of the land encompassing the critical habitat is Federally owned and managed by the U.S. Forest Service and the Bureau of Land Management.

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[6] In addition to the exclusion of HCP lands, the Service proposes to exclude Department of Defense lands at the Jim Creek Naval Radio Station (as per the Sikes Act Improvement Act of 1997) as well as forest lands on the Quinault Indian Reservation already covered by an existing Forest Management Plan.

The Service is also proposing to designate critical habitat in 88 miles (142 km) of streams and 6,295 acres (2,548 ha) of lakes in northwest Montana for the Saint Mary-Belly River population of bull trout. The majority of lands encompassing critical habitat for this population are either Federally or Tribally owned. About 45 percent of the lands are located within Glacier National Park, managed by the National Park Service, and another 45 percent are tribal lands managed by the Blackfeet Indian Tribe.

COASTAL-PUGET SOUND: DISTRIBUTION OF ECONOMIC EFFECTS AMONG LISTED SPECIES

There are several salmonid species that are listed as threatened or are candidates for listing under the Act, whose ranges overlap the proposed CHD for the Coastal-Puget Sound population of bull trout (see Map 9 in the Map Attachment).[7] Conservation activities designed to protect bull trout may provide coincident protection to other fish species, particularly salmon and steelhead. Conversely, conservation activities designed specifically for salmon provide coincident protection to bull trout. In assigning costs for fish-related conservation activities in watersheds that support both previously listed salmon species and the proposed bull trout CHD, this analysis assumes that the economic effect of fish-related conservation measures *is attributed co-extensively to both species*. That is, where a conservation activity provides indivisible benefits to both species in an overlapping watershed, the cost of the activity is apportioned to both species as “Impacts Associated with Co-Extensive Salmon and Bull Trout Conservation Activities.” In HUCs where proposed critical habitat for the bull trout does not overlap with the range of other listed species, the impact assessment follows the basic analytic framework described above, and the costs are assigned solely to bull trout conservation activities.

SUMMARY OF RESULTS FOR THE COASTAL-PUGET SOUND, JARBIDGE RIVER, AND SAINT MARY-BELLY RIVER POPULATIONS OF BULL TROUT

This section addresses the economic effects of conservation activities attributable to bull trout for the three populations. Retrospective costs in proposed critical habitat total $244.0 million. The Coastal-Puget Sound population represents about 99 percent of the costs. The costs for the Coastal-Puget Sound are co-extensive with listed salmon. Retrospective costs in areas proposed for exclusion in the Coastal-Puget Sound are $236.8 million. Excluded areas represent an additional $68.9 million. There are no areas excluded or proposed for exclusion in the Jarbidge River and Saint Mary-Belly River regions.

The prospective costs in the proposed critical habitat are $690.2 million assuming a seven percent discount rate. Annualized prospective costs are estimated to be $61.8 million, more than 98 percent of which is in the Coastal-Puget Sound region. Prospective costs in the area proposed for exclusion are $213.4 million. Annualized prospective costs are $20.1 million. Prospective costs in the excluded areas total $157.4 million, or $14.9 million annually.

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7 As shown in Map 9, a total of 53 of the 83 HUCs identified as containing proposed critical habitat overlap with listed salmon.

This analysis considers how small entities, including small businesses, organizations, and governments, may be affected by future bull trout conservation activities. In addition, this analysis considers the impacts of conservation activities on the energy industry and its customers. While small business impacts are discussed, significant impacts on the energy sector are not expected. See Appendix A for an analysis of impacts to small businesses and the energy industry.

Table ES-1
Summary of Economic Impacts Associated with Bull Trout Conservation Activities – Coastal-Puget Sound, Jarbidge River, and Saint Mary-Belly River

Region		Retrospective (Total) (1998–2004)	Prospective (Total) (2005–2024)		Prospective (Annualized)
			3%	7%	
Coastal-Puget Sound[a/]	Proposed Critical Habitat	$241,498,000	$994,693,000	$679,333,000	$60,756,000
	Proposed for Exclusion	$236,775,000	$299,710,000	$213,419,000	$20,145,000
	Excluded	$68,933,000	$221,094,000	$157,438,000	$14,861,000
Jarbidge River		$1,362,000	$2,885,000	$2,071,000	$215,000
Saint Mary-Belly River		$1,098,000	$12,718,000	$8,770,000	$828,000
Total Economic Effect	**Proposed Critical Habitat**	**$243,958,000**	**$1,010,296,000**	**$690,174,000**	**$61,779,000**
	Proposed for Exclusion	**$236,775,000**	**$299,710,000**	**$213,419,000**	**$20,145,000**
	Excluded	**$68,933,000**	**$221,094,000**	**$157,438,000**	**$14,861,000**

a/ Coastal-Puget Sound impacts are co-extensive with salmon and bull trout conservation activities.

COASTAL-PUGET SOUND: SUMMARY OF RESULTS

This section addresses the economic effects of conservation activities attributable to bull trout in the Coastal-Puget Sound region. The analysis measures effects on residential and commercial development, forest practices, hydroelectric and other dams, Federal land management, roads and transportation, mining, utilities, dredging and instream activities, culverts, and Federal agencies.

Table ES-2 provides a summary of the economic impacts associated with co-extensive salmon and bull trout conservation activities in the Coastal-Puget Sound region for each of the activities considered in this analysis. The table reflects the activities and the cost estimates reflect the fully co-extensive fish conservation costs such that, in HUCs where bull trout proposed critical habitat is designated overlaps with ESUs of listed salmon species, all of the costs associated with fish-related conservation measures are included. Results are presented for the three categories of analysis: proposed critical habitat, proposed for exclusion, and excluded.

Retrospective costs in proposed critical habitat total $241.5 million with non-hydroelectric projects and Federal land management bearing $87.4 and $50.4 million of the costs, respectively. Retrospective costs in areas proposed for exclusion are $236.8 million, and those for excluded areas are $68.9 million. The costs in these latter two categories are primarily associated with the effects of implementing the Forest and Fish Report on private forestlands, and conservation measures on HCP lands.

Table ES-2
Summary of Economic Effects Associated with Co-Extensive Salmon and Bull Trout Conservation Activities in the Coastal-Puget Sound Region:*
Proposed Critical Habitat, Proposed for Exclusion, and Excluded Areas

Category of Effect	Retrospective (Total)	Prospective (Total)		Prospective (Annualized)
		3%	7%	
Residential/Commercial Development	$0	$389,242,000	$277,173,000	$26,163,000
Hydroelectric Projects	$7,173,000	$101,938,000	$70,720,000	$5,124,000
Non-Hydroelectric Projects	$87,401,000	$154,244,000	$82,732,000	$5,995,000
Federal Land Management (USFS)	$50,448,000	$103,448,000	$73,664,000	$6,953,000
Private Non-HCP Forestry	$0	$0	$0	$0
HCP Lands	$411,000	$34,908,000	$24,857,000	$2,346,000
Road Maintenance and Transportation	$17,472,000	$26,409,000	$18,806,000	$1,775,000
Commercial and Recreational Mining	$0	$5,309,000	$3,780,000	$357,000
Utilities	$1,025,000	$1,863,000	$1,327,000	$125,000
Dredging Activities	$6,824,000	$14,007,000	$9,974,000	$941,000
Instream Activities	$27,753,000	$49,832,000	$35,484,000	$3,349,000
Culverts	$2,483,000	$3,920,000	$2,791,000	$263,000
NPDES-Permitted Facilities	$0	$0	$0	$0
Administrative Consultation Costs[a/]	$40,508,000	$109,573,000	$78,025,000	$7,365,000
Total Proposed Critical Habitat	**$241,498,000**	**$994,693,000**	**$679,333,000**	**$60,756,000**
Proposed for Exclusion	**$236,775,000**	**$299,710,000**	**$213,419,000**	**$20,145,000**
Excluded	**$68,933,000**	**$221,094,000**	**$157,438,000**	**$14,861,000**

Totals may not sum due to rounding

[a/] Administrative consultation costs are based on the historic consultation record and are not apportioned to specific HUC watersheds.

* Cost estimates included in this table and throughout the Coastal-Puget Sound portion of this report include the total cost of conservation activities associated with listed fish species in overlapping watersheds. That is, when conservation activities benefit listed salmon and bull trout, the full cost of the activity is included (i.e., total costs are not apportioned to either salmon or bull trout individually). In watersheds where only bull trout are proposed for critical habitat (see Map 9), the costs presented are attributable only to bull trout.

Total prospective costs on proposed critical habitat are $679.3 million assuming a seven percent discount rate. Annualized prospective costs are estimated to be $60.8 million. Costs associated with development contribute more than 49 percent of the overall prospective costs.[8] As discussed in Section 2.3.2.1, the impact of bull trout conservation activities on residential and commercial development may include additional requirements for sedimentation reduction or stormwater management may be required. Based on an analysis of implementing minimum stormwater control requirements applied to commercial, residential, and mixed development in the Puget Sound region, total prospective costs were determined to be $26.2 million annually (see Section 3.3). The majority of the cost burden (about 75 percent) falls on the commercial sector.

Other cost leading activities include Federal land management (13 percent), non-hydroelectric projects (11 percent), and hydroelectric projects (10 percent). For areas proposed for exclusion, the total prospective costs are $213.4 million, with annualized prospective costs estimated to be $20.1 million. These apply entirely to the private forestlands not covered by an HCP.

In the Puget Sound Unit, costs associated with residential and commercial development are among the highest category of costs. Appendix B contains a discussion of issues in the assessment of development costs.

Discussion of Results by CHSU

As noted earlier, the Service proposed critical habitat in the form of specific stream reaches, and in accompanying geographic areas. These critical habitat subunits generally follow watershed boundaries and encompass these stream reaches. The two units (Olympic and Puget Sound) contain ten and 13 critical habitat subunits (CHSUs), respectively. Table ES-3 provides a summary of economic effects associated with co-extensive salmon and bull trout conservation activities by CHSU for the two units.

For the total retrospective costs of $241.5 million, the CHSU with the highest costs is Lower Green at $72.8 million, followed by Lake Washington ($28.5 million), the Lower Skagit ($14.1 million), and Snohomish/Skykomish ($11.8 million). Lower Green and Lake Washington include relatively high costs from non-hydroelectric facilities (Hansen Dam and Chittenden Locks) and the King County HCP.

For total prospective costs of $679.3 million, the CHSU with the highest costs is the Lower Green, at $131.9 million, followed by Lake Washington at $77.6 million, Puyallup ($75.7 million), Lower Skagit ($56.6 million), Snohomish/Skykomish ($47.9 million), and Puget Sound Marine ($40.6 million). All six areas are highly urbanized and subject to high development costs. Puget Sound Marine encompasses a relatively long coastal marine area along the entire east shore of the Puget Sound. It is also urbanized and has high costs associated with development.

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8 Percentage calculated using total proposed critical habitat prospective costs, net of administrative consultation costs. Administrative costs were not apportioned to specific HUCs.

Table ES-3
Summary of Economic Effects Associated with Co-Extensive Salmon and Bull Trout Conservation Activities by CHSU: Proposed Critical Habitat

Unit	CHSU	Retrospective (Total)	Prospective (Total)		Prospective (Annualized)
			3%	7%	
Olympic	Skokomish	$2,515,000	$38,681,000	$27,544,000	$2,600,000
Olympic	Dungeness	$996,000	$11,262,000	$8,020,000	$757,000
Olympic	Elwha	$281,000	$669,000	$477,000	$45,000
Olympic	Hoh	$292,000	$922,000	$657,000	$62,000
Olympic	Queets	$1,703,000	$3,749,000	$2,670,000	$252,000
Olympic	Quinault	$1,780,000	$2,767,000	$1,970,000	$186,000
Olympic	Hood Canal	$210,000	$833,000	$593,000	$56,000
Olympic	Strait of Juan de Fuca	$798,000	$6,739,000	$4,799,000	$453,000
Olympic	Pacific Coast	$53,000	$208,000	$148,000	$14,000
Olympic	Chehalis River/ Grays Harbor	$6,000,000	$24,578,000	$17,501,000	$1,652,000
Puget Sound	Chilliwack	$372,000	$848,000	$604,000	$57,000
Puget Sound	Nooksack	$4,573,000	$17,094,000	$12,173,000	$1,149,000
Puget Sound	Lower Skagit	$14,055,000	$79,520,000	$56,625,000	$5,345,000
Puget Sound	Upper Skagit	$10,044,000	$10,013,000	$7,130,000	$673,000
Puget Sound	Stillaguamish	$5,520,000	$15,755,000	$11,219,000	$1,059,000
Puget Sound	Snohomish/Skykomish	$11,779,000	$67,321,000	$47,938,000	$4,525,000
Puget Sound	Chester Lake	$453,000	$10,459,000	$7,448,000	$703,000
Puget Sound	Puyallup	$8,560,000	$106,285,000	$75,684,000	$7,144,000
Puget Sound	Samish	$1,509,000	$7,573,000	$5,392,000	$509,000
Puget Sound	Lake Washington	$28,475,000	$108,933,000	$77,569,000	$7,322,000
Puget Sound	Lower Green	$72,849,000	$185,269,000	$131,927,000	$12,453,000
Puget Sound	Lower Nisqually	$417,000	$4,716,000	$3,358,000	$317,000
Puget Sound	Puget Sound Marine	$2,325,000	$56,951,000	$40,554,000	$3,828,000
Outside of Proposed CHSUs		**$26,383,000**	**$33,236,000**	**$23,667,000**	**$2,234,000**
Administrative Consultation Costs[a/]		**$40,508,000**	**$109,573,000**	**$78,025,000**	**$7,365,000**
Total – Proposed Critical Habitat		**$241,498,000**	**$994,693,000**	**$679,334,000**	**$60,756,000**

a/ Administrative consultation costs were not apportioned by CHSU.

DISCUSSION OF RESULTS BY WATERSHED

There are 83 HUCs in the Coastal-Puget Sound region that contain proposed critical habitat. Table ES-4 shows the ten watersheds with the highest prospective annualized costs associated with co-extensive salmon and bull trout conservation activities. Nine of the ten are within the Puget Sound Unit, between the Skagit River in the north and the Puyallup River in the South, and seven of these contain significant development costs; not surprisingly, they encompass highly urbanized areas of Puget Sound. Together, these seven watersheds represent 48 percent of the total economic impact within proposed critical habitat.[9] Costs in the Middle Green River watershed are primarily attributable to conservation activities at the Howard Hansen Dam and the City of Tacoma's water diversion. High costs in the Baker River watershed are due primarily to the upper and lower Baker Dam, where significant capitals costs are expected associated with a fish passage project beginning in 2006. Together, these ten watersheds in Coastal-Puget Sound represent 70 percent of the annualized economic impacts associated with the lands proposed for critical habitat.[10]

The watershed with the fifth highest prospective annualized cost is the Skokomish River, which flows southeast into the Hood Canal, in the Olympic Peninsula Unit. Capitals costs associated with the Cushman Hydroelectric Project fish passage improvement (anticipated to begin in 2006) are the most significant impacts in this watershed.

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9 Percentage calculated using total annual proposed critical habitat prospective costs, net of administrative consultation costs. Administrative costs were not apportioned to specific HUCs.

10 Percentage calculated using total annual proposed critical habitat prospective costs, net of administrative consultation costs. Administrative costs were not apportioned to specific HUCs.

Table ES-4
Highest Cost Watersheds in Coastal-Puget Sound Population: Proposed Critical Habitat

Watershed Name (HUC Code)	CHSU	Annualized Prospective Costs	Highest Cost Category	Highest Cost Category (% Impact)
Lower Green River (1711001303)	Lower Green	$9,190,000	Development	93%
Lake Washington (1711001203)	Lake Washington	$7,322,000	Development & Non-Hydro	43% & 33%
Lower Puyallup River (1711001405)	Puyallup	$5,793,000	Development	93%
Middle Green River (1711001302)	Lower Green	$3,263,000	Non-Hydro	94%
Skokomish River (1711001701)	Skokomish	$2,600,000	Hydro	84%
Snohomish River (1711001102)	Snohomish/ Skykomish	$2,517,000	Development	88%
Baker River (1710000508)	Lower Skagit	$2,264,000	Hydro	84%
Puget Sound/ East Passage[a/] (1711001904)	Puget Sound Marine	$1,634,000	Development	86%
Lower Skagit River/ Nookachamps Creek (1711000702)	Lower Skagit	$1,347,000	Development	89%
Chambers Creek[a/] (1711001906)	Puget Sound Marine	$1,232,000	Development	99%

[a/] Chambers Creek and Puget Sound/East Passage HUC watershed are both "nearshore marine habitat HUCs" and costs are adjusted to reflect this type of designation (see Section 2.2.1).

JARBIDGE RIVER: SUMMARY OF RESULTS

This section addresses the economic effects of conservation activities attributable to bull trout in the Jarbidge River area. The analysis measures effects on roads and transportation, grazing, and State and Federal agencies. Other activities, including recreation and mining, were found to have no costs attributable to the bull trout conservation activities.

Table ES-5 provides a summary of the economic impacts due to bull trout conservation activities for each of the activities considered in this analysis. Retrospective costs total $1.4 million, split among grazing, agency costs, and roads and transportation. Total prospective costs are $2.1 million using a seven percent discount rate.

Annualized prospective costs are estimated to be $215,000. Costs associated with grazing account for nearly half the prospective costs. These are based primarily on planning, monitoring, and reporting requirements associated with grazing leases.

Table ES-5
Summary of Economic Impacts Associated with Bull Trout Conservation Activities in the Jarbidge River Population

Category of Impact	Retrospective (Total) (1998–2004)	Prospective (Total) (2005–2024)		Prospective (Annualized)
		3%	7%	
Roads and Transportation	$344,000	$536,000	$382,000	$36,000
Grazing	$578,000	$1,427,000	$1,032,000	$117,000
Mining	$0	$0	$0	$0
Recreation	$0	$0	$0	$0
State and Federal Agencies	$440,000	$922,000	$657,000	$62,000
Total Impact	**$1,362,000**	**$2,885,000**	**$2,071,000**	**$215,000**

Additional detail on the results of the analysis, including detailed cost estimates for each watershed, can be found in Appendix D. The map attachment to this report contains a map (Map 13) of the affected area within each watershed shaded according to relative costs (darker shading indicates higher costs).

SAINT MARY-BELLY RIVER: SUMMARY OF RESULTS

This section addresses the economic effects of conservation activities attributable to bull trout in the Saint Mary-Belly River area. The analysis measures effects on agriculture, project modifications, and State and Federal agencies. Other activities, including recreation and mining, were found to have no costs attributable to the bull trout conservation activities.

Table ES-6 provides a summary of the economic impacts due to bull trout conservation activities for each of the activities considered in this analysis. Retrospective costs total $1,098,000, associated primarily with section 7 consultation efforts between the Service and the U.S. Bureau of Reclamation regarding the Saint Mary-Milk River Project. Total prospective costs are approximately $8.8 million assuming a seven percent discount rate. Annualized prospective costs are estimated to be approximately $828,000. Costs associated with project modifications at the St. Mary diversion and Sherburne Dam, reduced water supply to the Milk River Project, and future administrative consultation costs account for the prospective costs.

Reductions in water supply to the Milk River Project could occur as a result of late summer minimum instream flow needs in Swiftcurrent Creek between Sherburne Reservoir and the St. Mary diversion. Such flows could reduce the amount of water available for transfer to the Milk River Project. The estimated costs to the project reflect lost agricultural producer profit. An additional regional impact would be associated with reduced crop production activity, resulting in an estimated $110,000 per year reduction in labor income and eight lost jobs.

Table ES-6
Summary of Economic Impacts Associated with Bull Trout Conservation Activities in the Saint Mary-Belly River Population

Category of Impact	Retrospective (Total) (1998–2004)	Prospective (Total) (2005–2024)		Prospective (Annualized)
		3%	7%	
Agriculture	$0	$813,084	$578,984	$54,652
Project Modifications	$0	$7,701,800	$5,198,200	$490,700
Mining	$0	$0	$0	$0
Recreation	$0	$0	$0	$0
State and Federal Agencies	$1,098,000	$3,905,337	$2,780,929	$262,500
Blackfeet Tribe	$0	$297,500	$211,900	$20,000
Total Impact	**$1,098,000**	**$12,717,700**	**$8,770,000**	**$827,800**

CAVEATS AND ASSUMPTIONS

The assumptions presented here include only those that apply in general to all areas included in the analysis. Similar information on assumptions and possible bias that apply specifically to individual populations appears later in the report, within the particular section related to the relevant CHD area. These general caveats describe factors that introduce uncertainty into the results of this analysis. Table ES-7 contains a summary of these key assumptions.

Table ES-7
Assumptions and Uncertainties Applicable to the General Analysis[a/]

Assumption	Direction of Bias
The analysis considers the cost of conservation and protection activities for the bull trout including those attributable to the listing, to CHD, or other state and local regulations.	+/-
The analysis focuses on economic activities occurring within fifth-field HUCs that contain stream reaches proposed for CHD. Although the Service proposes to exclude from the designation certain lands already covered by existing management, this does not affect the estimation of costs associated with	+/-

Assumption	Direction of Bias
conservation activities for the bull trout.	
The HUC level analysis includes aquatic reaches proposed as critical habitat, as well as adjacent land beyond the boundaries of the designated stream reaches, where the potential to affect the constituent elements of critical habitat are likely. Thus, all relevant costs in adjacent areas may be included.	+
Inevitably, actions taken to protect bull trout provide benefits to other salmon species. When conservation activities are implemented in areas of habitat overlap between listed salmon and bull trout, the analysis attributes the costs of the fish-related conservation activities co-extensively to both species.	+
The prospective portion of this analysis assumes that the Service will consult on future Federally-authorized activities that occur only within the areas proposed as critical habitat. As such, the analysis assumes no consultations will occur outside of the watersheds containing critical habitat.	+
Non-market benefits are not easily measured without additional resources, unless directly applicable and peer-reviewed analyses are readily available. Consequently, this analysis makes no attempt to measure the positive social welfare effects that may be associated co-extensively with CHD.	+

+: This assumption is likely to produce an upward bias in cost estimates.

-: This assumption is likely to produce a downward bias in cost estimates.

+/-: No direction of bias can be determined.

[a/] This table summarizes general caveats and assumptions related to the approach of the analysis. Detailed caveats and assumptions are described under relevant sections for each analyzed activity.

This report addresses the economic impacts associated with conservation activities of the listing and proposed critical habitat designation (CHD) for three distinct populations of bull trout (*Salvelinus confluentus*, hereafter referred to as "bull trout"): Coastal-Puget Sound, Jarbidge River, and Saint Mary-Belly River. The U.S. Fish and Wildlife Service (hereafter "Service") published a proposed rule designating critical habitat for the three populations of bull trout in the *Federal Register* on June 25, 2004.[11] This analysis is consistent with the designation as described in the proposed rule. As such, this analysis does not reflect potential changes to the proposed CHD in the final rule. Description of the habitat designation in the final rule may consequently differ from that presented in this analysis.

This analysis is intended to assist the Secretary in determining whether the benefits of excluding particular areas from the designation outweigh the biological benefits of including those areas in the designation.[12] In addition, this information allows the Service to address the requirements of Executive Orders 12866 and 13211, and the Regulatory Flexibility Act (RFA), as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA).[13] This report also complies with direction from the U.S. 10th Circuit Court of Appeals that "co-extensive" effects should be included in the economic analysis to inform decision-makers regarding which areas to designate as critical habitat.[14]

This section provides the general analytic approach to estimating economic effects, including discussion of both efficiency and distributional effects. Next, it discusses the scope of the analysis, including the link between existing and critical habitat-related protection efforts and economic impacts. Then, it describes the information sources employed to conduct this analysis. Finally, it describes the background of the listing and proposed designation of critical habitat for the bull trout.

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11 U.S. Fish and Wildlife Service, June 25, 2004, "Proposed Designation of Critical Habitat for the Jarbidge River, Coastal-Puget Sound, and Saint Mary-Belly River Populations of Bull Trout, Proposed Rule," *Federal Register*, Vol. 69, No. 122, pp. 35768-35857.

12 16 U.S.C. § 1533(b)(2).

13 Executive Order 12866, September 30, 1993, "Regulatory Planning and Review;" Executive Order 13211, May 18, 2001, "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use;" 5 U.S.C. § 601 *et seq*; and Pub. Law No. 104-121.

14 In 2001, the U.S. 10th Circuit Court of Appeals instructed the Service to conduct a full analysis of all of the economic impacts of proposed CHD, regardless of whether those impacts are attributable co-extensively to other causes (*New Mexico Cattle Growers Ass'n vs. U.S.F.W.S.,* 248 F.3d 1277 (10th Cir. 2001)).

1.1 APPROACH TO ESTIMATING ECONOMIC EFFECTS

This economic analysis considers both the economic efficiency and regional economic impacts that may result from species and habitat protection. Economic efficiency effects generally reflect "opportunity costs" associated with the commitment of resources required to accomplish species and habitat conservation. For example, if activities on private lands are limited as a result of the designation or the presence of the species, and thus the market value of the land is reduced, this reduction in value represents one measure of opportunity cost or change in economic efficiency. Similarly, the costs incurred by a Federal action agency to consult with the Service under section 7 represent opportunity costs of habitat conservation, given that those resources committed to the CHD consultation process are not available for alternative activities. To the extent possible, the efficiency analysis also measures the distribution of these opportunity costs across groups, such as producers and consumers. For example, some costs related to conservation actions may fall entirely on one group, or may fall on individuals within a group, such as low income farmers. While economic efficiency is concerned with the total change in societal welfare from a given policy or action, and is thus the appropriate measure to ensure efficient use of resources, distributional measures can also be useful to policymakers in assessing who gains and who loses from such policies or actions.

This analysis also addresses the impacts associated with the CHD, including an assessment of any local or regional impacts of habitat conservation and the potential effects of conservation activities on small entities, the energy industry, or governments. This information may be used by decision-makers to assess whether the effects of the designation unduly burden a particular economic sector. For example, while habitat conservation activities may have a small impact relative to the national economy, individuals employed in a particular sector of the regional economy may experience a significant level of impact. The difference between economic efficiency effects and economic impacts, as well as their application in this analysis, are discussed in greater detail below.

Where data are available, the analysis attempts to capture the net economic impact imposed on regulated entities and the regional economy of bull trout conservation actions. That is, the economic impact of bull trout conservation to the land management agencies and regulated community net of any direct offsetting benefit they experience.

1.1.1 EFFICIENCY EFFECTS

At the guidance of the Office of Management and Budget (OMB) and in compliance with Executive Order 12866 "Regulatory Planning and Review," Federal agencies measure changes in economic efficiency in order to discern the implications on a societal level of a regulatory action. For regulations specific to the conservation of the bull trout, efficiency effects represent the opportunity cost of resources used, or benefits foregone, by society as a result of the regulations. Economists generally characterize opportunity costs in terms of changes in producer and consumer surplus in affected markets.[15]

In some instances, compliance costs may provide a reasonable approximation for the efficiency effects associated with a regulatory action. For example, a landowner or manager may enter into a consultation with the Service to ensure that a particular activity will not adversely modify critical habitat. The effort required for the consultation is an economic opportunity cost, because the landowner or manager's time and effort would have been spent in an alternative activity had his or her land not been designated critical habitat. In the case that compliance activity is not expected to significantly affect markets – that is, not result in a shift in the quantity of a good or service provided at a given price, or in the quantity of a good or service demanded given a change in price – the measurement of compliance costs provides a reasonable estimate of the change in economic efficiency.

Where habitat protection activities are expected to significantly affect a market, it may be necessary to estimate changes in producer and consumer surpluses. For example, a designation that precludes the development of large areas of land may shift the price and quantity of housing supplied in a region. In this case, changes in economic efficiency (i.e., social welfare) can be measured by considering changes in producer and consumer surplus in the real estate market.

This analysis begins by measuring costs associated with measures taken to protect species and habitat. As noted above, in some cases, compliance costs can provide a reasonable estimate of changes in economic efficiency. In the case of the bull trout, compliance costs are in fact expected to represent a reasonable estimate of efficiency effects, and thus effects on consumer and producer surpluses in affected markets are considered but not estimated.

1.1.2 DISTRIBUTIONAL EFFECTS AND REGIONAL ECONOMIC IMPACTS

Measurements of changes in economic efficiency focus on the net impact of conservation activities across broad aggregates of people (i.e., producers and consumers), without consideration of how certain economic sectors or groups of people (e.g., low income farmers) are affected. As noted above, these distributional or equity effects regarding how efficiency gains or losses are borne may be important to policymakers. In addition, economic efficiency effects do not address issues related to impacts on local or regional economies. Thus, a discussion of efficiency effects alone may miss important distributional considerations, as well as impacts on local economies. OMB encourages Federal agencies to consider

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15 For additional information on the definition of "surplus" and an explanation of consumer and producer surplus in the context of regulatory analysis, see Gramlich, Edward M., 1990, *A Guide to Benefit-Cost Analysis (2nd Ed.)*, Prospect Heights, Illinois: Waveland Press, Inc.; and U.S. Environmental Protection Agency, September 2000, *Guidelines for Preparing Economic Analyses*, EPA 240-R-00-003, http://yosemite.epa.gov/ee/epa/eed.nsf/webpages/Guidelines.html.

these latter effects separately from efficiency effects.[16] This analysis considers several types of these effects, including impacts on small entities; impacts on energy supply, distribution, and use; and regional economic impacts. It is important to note that these impacts on local economies or sectors are fundamentally different measures of economic costs than efficiency effects, and thus cannot be added to or compared with estimates of changes in economic efficiency.

1.1.2.1 Impacts on Small Entities and Energy Supply, Distribution, and Use

This analysis considers how small entities, including small businesses, organizations, and governments, as defined by the RFA, may be affected by future bull trout conservation activities.[17] In addition, in response to Executive Order 13211 "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use," this analysis considers the impacts of conservation activities on the energy industry and its customers.[18] While small business impacts are discussed, significant impacts on the energy sector are not expected. See Appendix A for an analysis of impacts to small businesses and the energy industry.

1.1.2.2 Regional Economic Impacts

Regional economic impact analysis can provide an assessment of the potential localized effects of conservation activities. Specifically, regional economic impact analysis produces a quantitative estimate of the potential magnitude of the initial change in the regional economy resulting from a regulatory action. Regional economic impacts are commonly measured using input/output models. These models rely on multipliers that represent the relationship between a change in one sector of the economy (e.g., expenditures by recreationists) and the effect of that change on economic output, income, or employment in other local industries (e.g., suppliers of goods and services to recreationists). These economic data provide a quantitative estimate of the magnitude of shifts of jobs and revenues in the local economy.

The use of regional input/output models in an analysis of the impacts of species and habitat conservation efforts can overstate the long-term impacts of a regulatory change. Most importantly, these models provide a static view of the economy of a region. That is, they measure the initial impact of a regulatory change on an economy but do not consider long-term adjustments that the economy will make in response to this change. For example, these models provide estimates of the number of jobs lost as a result of a regulatory change, but do not consider re-employment of these individuals over time or other adaptive responses by affected businesses. In addition, the flow of goods and services across the regional

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16 U.S. Office of Management and Budget, September 17, 2003, "Circular A-4," http://www.whitehouse.gov/omb/circulars/a004/a-4.pdf.

17 5 U.S.C. § 601 *et seq.*

18 Executive Order 13211, May 18, 2001, "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use."

boundaries defined in the model may change as a result of the regulation, compensating for a potential decrease in economic activity within the region.

Despite these and other limitations, in certain circumstances regional economic impact analysis may provide useful information about the scale and scope of localized impacts. It is important to remember that measures of regional economic effects generally reflect shifts in resource use rather than efficiency losses. Thus, these types of distributional effects are reported separately from efficiency effects (i.e., not summed). In addition, measures of regional economic impact cannot be compared with estimates of efficiency effects, but should be considered as distinct measures of impact.

1.2 Scope of the Analysis

This analysis identifies those economic activities believed to most likely threaten the listed species and its habitat and, where possible, quantifies the economic impact to avoid, mitigate, or compensate for such threats within the boundaries of the CHD. In instances where critical habitat is being proposed after a species is listed, some future impacts may be unavoidable, regardless of the final designation and exclusions under section 4(b)(2). However, due to the difficulty in making a credible distinction between listing and critical habitat effects within critical habitat boundaries, this analysis considers all future conservation-related impacts to be co-extensive with the designation.[19]

Co-extensive effects may also include impacts associated with overlapping protective measures of other Federal, State, and local laws that aid habitat conservation in the areas proposed for designation. It is noted that in past instances, some of these measures have been precipitated by the listing of the species and impending designation of critical habitat. Because habitat conservation efforts affording protection to a listed species likely contribute to the efficacy of the CHD efforts, the impacts of these actions are considered relevant for understanding the full effect of the proposed CHD. Enforcement actions taken in response to violations of the Act, however, are not included.

The bull trout critical habitat economic analysis includes the following items:

1. Consistent with recent court rulings, the analysis includes impacts that occur co-extensively with the listing under the Act. Enforcement actions taken in response to violations of the Act are not included.

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[19] In 2001, the U.S. 10th Circuit Court of Appeals instructed the Service to conduct a full analysis of all of the economic impacts of proposed CHD, regardless of whether those impacts are attributable co-extensively to other causes (*New Mexico Cattle Growers Ass'n vs. U.S.F.W.S.,* 248 F.3d 1277 (10th Cir. 2001)). In 2004, the U.S. 9th Circuit invalidated the Service's regulation defining destruction or adverse modification of critical habitat (*Gifford Pinchot Task Force v. United States Fish and Wildlife Service)*. The Service is currently reviewing the decision to determine what effect it (and to a limited extent *Center for Biological Diversity v. Bureau of Land Management* (Case No. C-03-2509-SI, N.D. Cal.)) may have on the outcome of consultations pursuant to section 7 of the Act.

2. The analysis considers conservation and protection activities for the bull trout. No distinction is made between impacts that occur due to listing and those that result from CHD. It also includes conservation activities at the state or local level that are the result of either the listing or CHD.

3. Inevitably, actions taken to protect bull trout provide benefits to other species. Where possible, this analysis addresses this issue by (1) focusing on the costs of fish-related conservation activities rather than general habitat improvements; (2) excluding activities implemented prior to the bull trout listing; and (3) excluding activities designed specifically for salmon in the Coastal-Puget Sound. Finally, when conservation activities are implemented in areas of habitat overlap between listed salmon and bull trout, the analysis includes the full costs of the fish-related conservation activities as co-extensive with salmon and bull trout.

4. Both retrospective and prospective costs are considered. Retrospective costs include those that have accrued since the time that the bull trout listing was proposed in 1998 but prior to designation of critical habitat. Prospective effects include likely future costs associated with bull trout conservation activities from 2005 to 2024. Retrospective impacts include costs associated with *implementing* fish-related conservation activities between 1998 and 2004, even if the impetus for those activities was a Federal, State, or local regulation prior to 1998.

5. The geographic scope of the analysis reflects the distinct areas inhabited by the three populations of bull trout that are the subject of this analysis: the Olympic Peninsula, Puget Sound, and portions west of the Cascade Mountains of Washington; the Jarbidge River basin in northern Nevada and southern Idaho; and the Saint Mary and Belly River basins in northern Montana.

6. The geographic unit of analysis in all areas is the fifth-field Hydrologic Unit Code (HUC), as defined by the U.S. Geological Survey, which correspond to watersheds.[20] The analysis focuses on economic activities occurring within fifth-field HUCs that contain stream reaches included in the proposed CHD (see Maps 2, 3, and 4 in the Map Attachment).

7. The Service has excluded and proposed for exclusion from CHD certain lands already covered by existing management plans (e.g., lands covered by Habitat Conservation Plans, private forestry lands, some tribal lands, and some Department of Defense lands) based on the belief that including these lands will provide little additional benefit to the species.[21] However, the exclusion or proposed exclusion of these lands from the proposed CHD does not affect this

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[20] Throughout the remainder of the document, the terms "HUC" and "watershed" are used interchangeably.

[21] For the Coastal-Puget Sound population of bull trout, the Service has excluded from CHD lands managed under four HCPs, and proposed for exclusion lands of the Quinault Indian Reservation and lands covered by the Forest and Fish Report of 1999. Department of Defense lands at the Naval Radio Station Jim Creek were not included in the bull trout CHD as per the Sikes Act Improvement Act of 1997.

economic analysis, which estimates the retrospective and prospective costs of conservation activities per watershed to protect bull trout, regardless of the impetus or regulatory program.[22]

8. The localized economic efficiency effects reflect the aquatic reaches proposed as critical habitat. However, activities occurring on adjacent land or beyond the boundaries of the proposed critical habitat with the potential to affect critical habitat, such as stream water quality, are also considered when appropriate.

9. This analysis utilizes a "with" and "without" framework, and emphasizes those effects that are determined to be attributable to bull trout conservation activities. Impacts that would have occurred without the bull trout listing and CHD are evaluated on a case-by-case basis to determine if they should be assigned, in part, to conservation activities for the bull trout.

10. The period of analysis and discounting is guided by the availability of information concerning the start date and duration of the activity. Each potential cost component is examined over the time period that is appropriate for that specific activity or investment. Some of these costs are incurred one time only, while others are recurring. These costs are presented both as net present values and annualized costs, using three and seven percent discount rates.

1.2.1 SECTIONS OF THE ACT RELEVANT TO ECONOMIC ANALYSIS

The analysis begins by estimating retrospective costs incurred from the time that the three bull trout populations were first proposed for listing in 1998 through the final designation of critical habitat in 2005. It focuses on activities that are influenced by the Service through sections 4, 7, 9, and 10 of the Act. It then looks at activities likely to occur post-designation, and quantifies the effects that sections 4, 7, 9, and 10 of the Act may have on those activities.

Section 4 of the Act focuses on the listing and recovery of endangered and threatened species, as well as CHD. In this section, the Secretary is required to designate species as endangered or threatened "solely on the basis of the best scientific and commercial data available."[23] Under section 4(d), the Service may write regulations to provide for the conservation of threatened species. The implementation of these regulations may have economic impacts on resource managers, landowners, and other relevant parties. There is a special rule in place for the bull trout, the principal effect of which is to allow take in accordance with State, National Park Service (NPS), and Native American tribal permitted fishing

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22 The economic analysis considers all geographic regions considered in the Proposed Rule designating critical habitat for bull trout, regardless of land status. Economic effects are presented for areas proposed for CHD, proposed for exclusion, and excluded from CHD.

23 16 U.S.C. § 1533.

activities.[24] The Service has also proposed an additional special rule under Section 4(d) that would exempt certain habitat restoration activities and other land and water management activities from take prohibitions when specific criteria are met. These activities could involve some level of impact, but would fall within an overall framework contributing to the conservation of bull trout.[25]

The protections afforded to threatened and endangered species and their designated critical habitat are described in sections 7, 9, and 10 of the Act. The economic effects of these protections are considered in this analysis:

- Section 7 of the Act requires Federal agencies to consult with the Service to ensure that any action they authorize, fund, or carry out will not likely jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of the species' designated critical habitat. The administrative costs of these consultations, along with the costs of project modifications resulting from these consultations, represent compliance costs associated with the listing of the species and the designation of critical habitat.[26]

- Section 9 defines the actions that are prohibited by the Act, and in particular, prohibits the "take" of endangered wildlife. The term "take" means to "harass, harm, pursue, … or collect, or to attempt to engage in any such conduct."[27] Such act may include "significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering."[28] The economic impacts associated with this section manifest themselves in sections 7 and 10, though these impacts do not directly flow from or depend on the designation of critical habitat.

- Under section 10(a)(1)(B) of the Act, an entity (e.g., a landowner or local government) may develop a Habitat Conservation Plan (HCP) for a species in order to meet the conditions for

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24 U.S. Fish and Wildlife, November 1, 1999, "Determination of Threatened Status for Bull Trout in the Coterminous United States, Final Rule," *Federal Register*, Vol. 64, No. 210, pp. 58929-58930. It should be noted that the 4(d) rule for the Jarbidge River population is no longer valid, having expired after two years when Idaho and Nevada did not complete a new bull trout management plan (personal communication with Service Biologist, Nevada Fish and Wildlife Office, Reno, Nevada, July 30, 2004).

25 U.S. Fish and Wildlife, November 1, 1999, "Notice of Intent to Prepare a Proposed Special Rule Pursuant to Section 4(d) of the Endangered Species Act for Bull Trout," *Federal Register,* Vol. 64, No. 210, pp. 58934-58936.

26 The Service notes, however, that a recent Ninth Circuit judicial opinion, *Gifford Pinchot Task Force v. United States Fish and Wildlife Service*, has invalidated the Service's regulation defining destruction or adverse modification of critical habitat. The Service is currently reviewing the decision to determine what effect it (and to a limited extent *Center for Biological Diversity v. Bureau of Land Management* (Case No. C-03-2509-SI, N.D. Cal.)) may have on the outcome of consultations pursuant to section 7 of the Act.

27 16 U.S.C. § 1532.

28 U.S. Fish and Wildlife Service, February 2004, "ESA Basics," http://endangered.fws.gov/pubs/esa_basics.pdf.

issuance of an incidental take permit in connection with the development and management of a property.[29] The requirements posed by the HCP may have economic impacts associated with the goal of ensuring that the effects of incidental take are adequately minimized and mitigated. The designation of critical habitat does not require completion of an HCP; however, the designation may influence conservation measures provided under HCPs. In the case of the bull trout, areas covered by four HCPs in the Coastal-Puget Sound region have been excluded from the CHD (see Section 3.2.2.2). In addition, two existing HCPs include coverage for the bull trout and fall within the boundaries for the economic analysis, and four additional HCPs currently under development also include bull trout related conservation activities (see Section 3.2.2.2). However, approximately half of land proposed for designation for the bull trout is Federally owned, and Federal agencies do not develop HCPs, but instead obtain permission for incidental take through the section 7 consultation process.

1.2.2 Other Relevant Protection Efforts

The protection of listed species and habitat is not limited to the Act. Other Federal agencies, as well as State and local governments, may also seek to protect the natural resources under their jurisdiction.[30] In addition, under certain circumstances, the CHD may provide new information to a community about the sensitive ecological nature of a geographic region, potentially triggering additional economic impacts under other State or local laws.

1.2.3 Additional Analytic Considerations

Previous economic impact analyses prepared to support critical habitat decisions have considered other types of economic impacts related to conservation activities associated with CHD, including time delay, regulatory uncertainty, and stigma impacts. This analysis considers these types of economic impacts and has determined that the proposed CHD for the bull trout is unlikely to have economic impacts of this nature.

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[29] U.S. Fish and Wildlife Service, "Endangered Species and Habitat Conservation Planning," http://endangered.fws.gov/hcp/, accessed August 6, 2002.

[30] For example, the Sikes Act Improvement Act (Sikes Act) of 1997 requires Department of Defense (DOD) military installations to develop Integrated Natural Resources Management Plans (INRMPs) that provide for the conservation, protection, and management of wildlife resources (16 U.S.C. 670a - 670o). These plans must integrate natural resource management with the other activities, such as training exercises, taking place at the facility.

1.2.4 BENEFITS

Under Executive Order 12866, OMB directs Federal agencies to provide an assessment of both the social costs and benefits of proposed regulatory actions.31 OMB's Circular A-4 distinguishes two types of economic benefits: direct benefits and ancillary benefits. Ancillary benefits are defined as favorable impacts of a rulemaking that are typically unrelated, or secondary, to the statutory purpose of the rulemaking.[32]

In the context of CHD, the primary purpose of the rulemaking (i.e., the direct benefit) is the potential to enhance conservation of the species. The published economics literature has documented that social welfare benefits can result from the conservation and recovery of endangered and threatened species. In its guidance for implementing Executive Order 12866, OMB acknowledges that it may not be feasible to monetize, or even quantify, the benefits of environmental regulations due to either an absence of defensible, relevant studies or a lack of resources on the implementing agency's part to conduct new research.[33] *Rather than rely on economic measures, the Service believes that the direct benefits of the proposed rule are best expressed in biological terms that can be weighed against the expected cost impacts of the rulemaking.*

CHD may also generate ancillary benefits. Critical habitat aids in the conservation of species specifically by protecting the primary constituent elements on which the species depends. To this end, critical habitat designation can result in maintenance of particular environmental conditions that may generate other social benefits aside from the preservation of the species. That is, management actions undertaken to conserve a species or habitat may have coincident, positive social welfare implications, such as increased recreational opportunities in a region. While they are not the primary purpose of critical habitat, these ancillary benefits may result in gains in employment, output, or income that may offset the direct, negative impacts to a region's economy resulting from actions to conserve a species or its habitat.

It is often difficult to evaluate the ancillary benefits of CHD. To the extent that the ancillary benefits of the rulemaking may be captured by the market though an identifiable shift in resource allocation, they are factored into the overall economic impact assessment in this report. For example, if decreased off-road vehicle use to improve species habitat leads to an increase in opportunities for wildlife viewing or hiking within the region, the local economy may experience an associated measurable, positive impact. Where data are available, this analysis attempts to capture the net economic impact (i.e., the increased regulatory burden less any discernable offsetting market gains), of species conservation efforts imposed on regulated entities and the regional economy.

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[31] Executive Order 12866, September 30,1993, "Regulatory Planning and Review."

[32] U.S. Office of Management and Budget, "Circular A-4," September 17, 2003, available at http://www.whitehouse.gov/omb/circulars/a004/a-4.pdf.

[33] Ibid.

1.2.4.1 The Potential for Amenity Values

When riparian areas are designated as critical habitat for a species, they may generate amenity values to adjacent property owners and residents. These amenity values are derived from the associated recreational opportunities, visual amenities, and other environmental and ecosystem benefits that may arise from the CHD. The existence and magnitude of economic values for environmental amenities are well documented in the environmental economics literature. If a CHD provides additional protection of the area, habitat, or ecosystem from which such environmental services may flow, the existence of positive values (negative costs) from a CHD is possible.

In the case of a CHD, owners of adjacent or nearby residential property may benefit from the "internalization" of the environmental public goods arising from the CHD. However, the extent of the impact on the welfare of owners of undeveloped land and developers in general is not always clear. For example, landowners and developers would not have an incentive to provide open space or related amenities unless they could capture some of the resulting value in the price of lots and houses. Some land developers of larger areas have voluntarily set aside portions of the potential development as open space, and have built in price premiums in remaining parcels to account for the advertised amenity. However, it is expected that owners of smaller parcels would have to engage in cooperative behavior with adjacent property owners to provide sufficient open space to provide price premiums adequate to offset the loss of revenue from reduced numbers of developable lots.

In the literature, the existence of amenity values has been demonstrated in a wide variety of settings and these values have been quantified with a number of non-market valuation techniques. Time and resource constraints often prohibit the performance of original, site-specific research to measure amenity values. Instead, potential amenity values are often quantified via the "benefits transfer" approach. This approach essentially borrows (transfers) estimates of value for the same non-marketed commodity (e.g., open space) from extant studies and applies them to a new site or setting. The conditions under which such procedures are valid are well discussed in the literature. The OMB also provides guidance for an appropriate use of benefits transfer methods, including criteria for their use.[34] In general, however, the closer the two sites are in terms of key physical and economic factors, the more likely it is that the transferred value is appropriate for the new setting. In addition, the literature cautions that values be used conservatively; i.e., that among those previous estimates judged to be appropriate, lower bound estimates should be used for the new application or setting.

In the case of bull trout conservation measures, the available literature did not provide studies of sufficient comparability in terms of the site characteristics or economic factors to justify assessment of amenity values through a benefits transfer approach. As such, this analysis recognizes the potential for the existence of amenity values within the bull trout CHD, but leaves such values unquantified.

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[34] U.S. Office of Management and Budget, September 17, 2003, "Circular A-4," http://www.whitehouse.gov/omb/circulars/a004/a-4.pdf.

1.2.5 ANALYTIC TIME FRAME

The analysis examines activities taking place both within and adjacent to the proposed CHD, and considers activities that have occurred since the proposed listing (1998) and prior to designation (2005), as well as activities anticipated to occur after designation. Estimates of post-designation effects are based on activities that are "reasonably foreseeable," including, but not limited to, activities that are currently authorized, permitted, or funded, or for which proposed plans are currently available to the public. The analysis estimates economic effects of activities from 1998 (year of the proposed rule for listing) through 2024 (20 years from the year of final CHD).[35] The time frame for analysis was selected to emulate a reasonable future period for recovery of the species.

1.3 INFORMATION SOURCES

The analysis contained in this report is based on information collected from a wide range of sources. Service personnel provided information on past bull trout section 7 consultation project modification and terms and conditions, as well as copies of formal bull trout consultation documents. The Service also supplied maps delineating the proposed critical habitat by management unit, as well as maps showing the location of major activities, including dams and reservoirs. The Service provided the output of requested GIS analysis for information on land ownership by management unit, as well as management status for several of the action agencies, including the USFS. Draft recovery plans produced by the Service for the Olympic Peninsula and Puget Sound Units (both part of the Coastal-Puget Sound population), the Jarbidge River population, and the Saint Mary-Belly River population were consulted, as well as listing documents for the bull trout.[36] The specific sources used to address the effects of bull trout conservation activities are identified within each section. A full list of information sources is provided in the reference section at the end of this report.

1.4 BACKGROUND OF THE BULL TROUT LISTING

The Service has listed under the Act a total of five populations of bull trout. Critical habitat was previously proposed for two populations (the Columbia River and Klamath River), and the economic effects of the designation were analyzed and presented in a report released in March 2004. The three remaining populations are the subjects of this report.

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35 In the case of hydroelectric and non-hydroelectric projects, some capital costs are spread over 50 years. This is discussed in Section 3.4 "Effects on Hydroelectric Projects and Other Water Storage Dams."

36 Recovery Plans are available at the Service's website, http://pacific.fws.gov/bulltrout/jcs/index.html#.

The three populations of bull trout were proposed for listing by the Service under the Act as "threatened" on June 10, 1998.[37] The final rule was published in the November 1, 1999, edition of the Federal Register,[38] along with the intent to prepare a proposed rule under Section 4(d) of the Act, or the issuance of regulations designed to conserve the species. Since then, the Service analyzed and proposed areas to be designated as critical habitat. In each of the three areas encompassing the populations, the Service developed draft recovery plans for the species. A draft recovery plan for the Saint Mary-Belly River population was released for public comment in November 2002. The recovery plan for the Saint Mary-Belly River population identified a range of actions that would be recommended in order to ensure recovery of the species in the region. These included alterations to the structure and operation of dams, impacts on the agricultural industry, and impacts on mining practices, each with potential economic consequences. Draft recovery plans for the Coastal-Puget Sound and Jarbidge River populations have been prepared and were released to the public in July 2004. These draft plans indicate that a potentially large number of actions may be recommended to facilitate recovery: modifications to dams, transportation networks, forest management practices, agricultural and grazing operations, fisheries management, and urban and suburban development. Modifications to these activities may result in economic costs.

1.5 Background of the Bull Trout Critical Habitat Designation

On January 26, 2001, the Alliance for the Wild Rockies, Inc., and Friends of the Wild Swan, Inc., filed a lawsuit in the U.S. District Court of Oregon challenging the failure of the Service to designate critical habitat for bull trout. Through a settlement agreement entered on January 15, 2002, the Service stipulated that it would make critical habitat determinations for five populations of bull trout.[39] For the Jarbidge River, Coastal-Puget Sound, and Saint Mary-Belly River populations, the Service agreed to submit for publication in the *Federal Register* a proposed critical habitat rule by October 1, 2003, and a final rule by October 1, 2004. A subsequent agreement resulted in extending the date for the finalization of the proposed rule by June 15, 2004, and completing a final rule by June 15, 2005.

The proposed critical habitat designation for the Coastal-Puget Sound population is comprised of two units: the Olympic Peninsula River Basins Unit and the Puget Sound River Basins Unit. This includes approximately 2,290 miles (3,685 km) of streams, 52,540 acres (21,262 ha) of lakes, and marine areas paralleling 985 miles (1,585 km) of marine shoreline in Washington. Areas excluded from CHD include lands covered by four existing HCPs (Map 12). Proposed for exclusion are those lands covered by the Washington State Forest Practices Rules and Regulations (Map 11) and lands on the Quinault Indian Reservation (Map 6). More than half of the land encompassing the critical habitat is privately owned.

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37 U.S. Fish and Wildlife Service, June 10, 1998, "Proposal to List the Coastal-Puget Sound, Jarbidge River and St. Mary-Belly River Population Segments of Bull Trout as Threatened Species, Proposed Rule," *Federal Register*, Vol. 63, No. 111, pp. 31693-31710.

38 U.S. Fish and Wildlife, November 1, 1999, "Determination of Threatened Status for Bull Trout in the Coterminous United States, Final Rule," *Federal Register*, Vol. 64, No. 210, pp. 58910-58933.

39 *Alliance for the Wild Rockies, Inc., Friends of the Wild Swan, Inc., v. Badgley et al.,* CV 01-127-JO (D. Ore.).

Habitat for the Jarbidge River population of bull trout will be protected within a total of 131 miles (211 km) of streams as critical habitat. These streams include the Jarbidge River and many of its headwater tributaries. These stream segments provide either foraging, migration, and overwintering (FMO) habitat, or provide spawning and rearing habitat. More than 90 percent of the land encompassing the critical habitat is Federally owned and managed by the U.S. Forest Service (USFS) and Bureau of Land Management (BLM).

The Service is also proposing to designate critical habitat in 88 miles (142 km) of streams and 6,295 acres (2,548 ha) of lakes in northwest Montana for the Saint Mary-Belly River population of bull trout. The majority of lands encompassing critical habitat for this population are either Federally or tribally owned. About 45 percent of the lands are located within Glacier National Park, managed by the NPS, and another 45 percent are tribal lands managed by the Blackfeet Indian Tribe.

1.6 DESCRIPTION OF THE SPECIES AND HABITAT[40]

Bull trout is a char native to waters of western North America. The historic range of bull trout includes major river basins in the Pacific Northwest from about 41° north to 60° north latitude, extending south to the McCloud River in northern California and the Jarbidge River in Nevada, and north to the headwaters of the Yukon River in Northwest Territories, Canada. To the west, bull trout range includes Puget Sound, various coastal rivers of British Columbia, Canada, and southeast Alaska. Bull trout are relatively dispersed throughout tributaries of the Columbia River Basin, including its headwaters in Montana and Canada. Bull trout also occur in the Klamath River basin of south-central Oregon. East of the Continental Divide in Canada, the bull trout's range includes the headwaters of the Saskatchewan River in Alberta, and the MacKenzie River system in Alberta and British Columbia.

Bull trout were first described as *Salmo spectabilis* by Girard in 1856 from a specimen collected on the lower Columbia River near The Dalles, Oregon, and subsequently described under a number of names such as *Salmo confluentus* and *Salvelinus malma*. Bull trout and Dolly Varden (*Salvelinus malma*) were previously considered a single species. However, in 1980, the American Fisheries Society formally recognized bull trout and Dolly Varden as separate species. Although bull trout and Dolly Varden co-occur in several northwestern Washington River drainages, there is little evidence of introgression and the two species appear to be maintaining distinct genomes.

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40 Information on the bull trout and its habitat is taken from the U.S. Fish and Wildlife Service, June 25, 2004, "Proposed Designation of Critical Habitat for the Jarbidge River, Coastal-Puget Sound, and Saint Mary-Belly River Populations of Bull Trout, Proposed Rule," *Federal Register*, Vol. 69, No. 122, pp. 35768-35857; U.S. Fish and Wildlife Service, April 8, 1999, "Determination of Threatened Status for the Jarbidge River Population Segment of Bull Trout, Final Rule," *Federal Register,* Vol. 64, No. 67, pp. 17110-17125; and U.S. Fish and Wildlife Service, November 1, 1999, "Determination of Threatened Status for Bull Trout in the Coterminous United States, Final Rule," *Federal Register*, Vol. 64, No. 210, pp. 58910-58933.

Bull trout exhibit both resident and migratory life history strategies through much of the current range. Resident bull trout complete their entire life cycle in the tributary streams where they spawn and rear. Migratory bull trout spawn in tributary streams where juvenile fish rear from one to four years before migrating to either a lake (adfluvial), river (fluvial), or, in certain coastal areas, saltwater (amphidromous), to mature. Resident and migratory forms may be found together, and bull trout may produce offspring exhibiting either resident or migratory behavior.

The Jarbidge River population is located in southwest Idaho and northern Nevada, and contains the southernmost habitat occupied by bull trout. This population is geographically segregated from other bull trout populations in the Snake River basin by a large expanse of unsuitable habitat and several impassable dams on the mainstem Snake River and the lower Bruneau River. Although historical distribution and abundance data for the Jarbidge River population are limited, bull trout were likely more abundant and widely distributed in the Bruneau and Jarbidge River basins than they are today. Currently, bull trout occur primarily in the Jarbidge River basin in both Idaho and Nevada. The Jarbidge River population includes six local populations of resident bull trout: (1) East Fork Jarbidge River (including the East Fork headwaters, Cougar Creek, and Fall Creek), (2) West Fork Jarbidge River (including Sawmill Creek), (3) Dave Creek, (4) Jack Creek, (5) Pine Creek, and (6) Slide Creek. Some remnant fluvial bull trout also remain. These populations are considered to be quite low in abundance and at risk of extirpation.

The Coastal-Puget Sound population encompasses all Pacific coast drainages within the conterminous United States north of the Columbia River in Washington, including those flowing into Puget Sound. The Coastal-Puget Sound population is geographically segregated from other populations by the Pacific Ocean and the crest of the Cascade Mountain Range, and is believed to contain the only amphidromous forms of bull trout in the coterminous United States. Historical reports for this population suggest that bull trout, especially the amphidromous form, were once more abundant and more widely distributed. Bull trout still occur in most major watersheds within the population, but the distribution and abundance within these watersheds often has been reduced by human-caused conditions. Bull trout are now rarely observed in the Nisqually River and Chehalis River systems, which may have supported spawning populations in the past. In the Puyallup River system, the amphidromous life history form currently exists in low numbers, as does the migratory form in the South Fork Skokomish River. In the Elwha River and parts of the Nooksack River, amphidromous bull trout are unable to access historic spawning habitat resulting from manmade barriers.

The Saint Mary-Belly River population includes headwaters of the Saint Mary and Belly river systems in the U.S. These two streams flow north, from high-elevation slopes along the Rocky Mountain front in north central Montana and are tributaries of the Saskatchewan River Basin in Alberta, Canada. This population of bull trout migrate across the international border with Canada. This population is the only portion of the coterminous U.S. range of bull trout that is located east of the Continental Divide. The historical distribution of bull trout within the Saint Mary-Belly River population is believed to be relatively intact. However, abundance of bull trout in the U.S. portions of these watersheds has been reduced, and portions of the habitat are fragmented from natural condition due to manmade structures such as dams and diversions. It is considered likely that the mountains and transitional zones of the Saint Mary and Belly River (the U.S. headwaters and upper reaches in Canada) were historical strongholds for bull trout in these drainages. In the lower reaches of the Saint Mary and Belly rivers in Alberta, bull trout may have been occasionally present, though they were not commonly distributed in these prairie streams.

Many factors have contributed to the decline of bull trout in the Jarbidge River, Coastal-Puget Sound, and Saint Mary-Belly River areas, and continue to pose significant risks to local populations of bull trout. Throughout their range, bull trout have been negatively impacted by isolation and habitat fragmentation resulting from barriers to migration, such as dams and water diversions. Within the Saint Mary-Belly River, water diversions in the U.S. and Canada are considered the primary threat to bull trout, causing entrainment of fish, disruption of migratory corridors, dewatering of instream habitat, and alteration of stream temperature regimes. Habitat degradation, resulting from past forest and rangeland management practices, mining, and roads, has also contributed to the decline of bull trout. Fisheries management, particularly fishing pressure and potential overharvest, has been identified as a factor negatively affecting the Jarbidge River population of bull trout. Amphidromous bull trout in the Coastal-Puget Sound region is threatened by the degradation of mainstem river foraging, migrating, and overwintering (FMO) habitat, and the degradation and loss of marine nearshore foraging and migration habitat. Harvest has also been identified as a factor negatively affecting bull trout in the Olympic Peninsula Unit of the Coastal-Puget Sound population.

The introduction and spread of non-native fish species, particularly the widespread stocking and establishment of brook trout (*Salvelinus fontinalis*), is another major issue affecting bull trout. Introduced brook trout threaten bull trout through hybridization, competition, and possibly predation. Brook trout appear to be better adapted to degraded habitat then bull trout, and brook trout are more tolerant of high water temperatures. Hybridization between brook trout and bull trout has been reported in Montana, Oregon, Washington, and Idaho. In addition, brook trout mature at an earlier age and have a higher reproductive rate than bull trout. This difference appears to favor brook trout over bull trout when they occur together, often leading to the decline or extirpation of bull trout. Non-native lake trout also negatively affect bull trout. In a study of 34 lakes in Montana, Alberta, and British Columbia, lake trout caused a reduction in the distribution and abundance of migratory bull trout in mountain lakes.

Compared to other salmonids, bull trout have more specific habitat requirements that appear to influence their distribution and abundance. Critical parameters include water temperature, cover, channel form and stability, valley form, spawning and rearing substrates, and migratory corridors.

Bull trout are found primarily in colder streams within a river system, although fish can occur throughout larger river systems; water temperatures above 15° Celsius (C) (59° Fahrenheit (F)) are believed to negatively influence bull trout distribution. Preferred spawning habitat generally consists of low gradient stream reaches often found in high gradient streams that have loose, clean gravel and water temperatures of 5° to 9° C (41° to 48° F) in late summer and early fall. These spawning areas are often associated with cold-water springs, groundwater infiltration, and the coldest streams of a given watershed.

All life history stages of bull trout are associated with complex forms of cover, including large woody debris, undercut banks, boulders, and pools. Maintaining bull trout populations requires stream channel and flow stability. Juvenile and adult bull trout frequently inhabit side channels, stream margins, and pools with suitable cover. These areas are sensitive to activities that directly or indirectly affect stream channel stability and alter natural flow patterns.

Bull trout are opportunistic feeders, with food habits that are primarily a function of size and life-history strategy. Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macro-zooplankton, and small fish. Adult migratory bull trout feed almost exclusively on other fish, including various trout and salmon species.

Migratory corridors link seasonal habitats for all bull trout life history forms. The ability to migrate is important to the persistence of local bull trout subpopulations. Migrations facilitate gene flow among local subpopulations if individuals from different subpopulations interbreed when some return to non-natal streams. Migratory fish may also reestablish extirpated local subpopulations.

The Service determined the primary constituent elements of bull trout habitat from studies of their habitat requirements, life history characteristics, and population biology, as outlined above. These primary constituent elements are:

1. Water temperatures ranging from 2° to 15° C (36° to 59° F), with adequate thermal refugia available for temperatures at the upper end of this range. Specific temperatures within this range will vary depending on bull trout life history stage and form, geography, elevation, diurnal and seasonal variation, shade, such as that provided by riparian habitat, and local groundwater influence.

2. Complex stream channels with features such as woody debris, side channels, pools, and undercut banks to provide a variety of depths, velocities, and instream structures.

3. Substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine subtrate less than 0.63 cm (0.25 in) in diameter and minimal substrate embeddedness are characteristic of these conditions.

4. A natural hydrograph, including peak, high, low, and base flows within historic ranges or, if regulated, a hydrograph that demonstrates the ability to support bull trout populations by minimizing daily and day-to-day fluctuations and minimizing departures from the natural cycle of flow levels corresponding with seasonal variation.

5. Springs, seeps, groundwater sources, and subsurface water connectivity to contribute to water quality and quantity.

6. Migratory corridors with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and foraging habitats, including intermittent or seasonal barriers induced by high water temperatures or low flows.

7. An abundant food base including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.

8. Few or no non-native predatory, interbreeding, or competitive species present.

9. Permanent water of sufficient quantity and quality such that normal reproduction, growth, and survival are not inhabited.

The bull trout critical habitat for the Jarbidge River, Coastal-Puget Sound, and Saint Mary-Belly River populations are designed by the Service to incorporate what is essential for their conservation. All lands identified as essential and proposed as critical habitat contain one or more of the primary constituent elements for bull trout.

1.7 PROPOSED CRITICAL HABITAT DESIGNATIONS

This analysis estimates the economic effects associated with proposed critical habitat as described in the Federal Register.[41] For additional information describing the biological habitats within the geographical areas of the Coastal-Puget Sound, Jarbidge River, and Saint Mary-Belly River populations, refer to that publication.

1.7.1 COASTAL-PUGET SOUND (UNITS 27 AND 28)

Two units comprise the Coastal-Puget Sound population (Map 1): the Olympic Peninsula River Basins (Unit 27) and Puget Sound River Basins (Unit 28). The Olympic Peninsula Unit is located in northwestern Washington and includes approximately 764 miles (1,229 km) of streams, 8,318 acres (3,366 ha) of lakes, and 419 miles (674 km) of marine shoreline proposed for designation of critical habitat for bull trout. Adjacent land ownership percentages for the lands adjacent to the proposed critical habitat designation in this unit are approximately 38 percent Federal, 7 percent tribal, 7 percent State, and 48 percent private. This unit extends across portions of Grays Harbor, Clallam, Mason, Pacific, and Jefferson counties. The unit is further divided into 10 critical habitat subunits (CHSUs), which are described in detail within the proposed CHD rule (see also Appendix C).

The Puget Sound Unit is located to the south and east of the Olympic Peninsula Unit and extends across Whatcom, Skagit, Snohomish, King, Pierce, Thurston, and Island counties. Proposed critical habitat for this unit includes approximately 1,526 miles (2,455 km) of streams, 44,222 acres (17,896 ha) of lakes, and 566 miles (911 km) of marine shoreline. Adjacent land ownership percentages for this unit are approximately 25 percent Federal, 3 percent tribal, 5 percent State, and 67 percent private. The Puget

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[41] U.S. Fish and Wildlife Service, June 25, 2004, "Proposed Designation of Critical Habitat for the Jarbidge River, Coastal-Puget Sound, and Saint Mary-Belly River Populations of Bull Trout, Proposed Rule," *Federal Register*, Vol. 69, No. 122, pp. 35768-35857.

Sound Unit is further divided into 13 CHSUs, which are also described in the proposed CHD rule (see also Appendix C).

The total proposed critical habitat designation for the Coastal-Puget Sound population includes approximately 2,290 miles (3,685 km) of streams, 52,540 acres (21,262 ha) of lakes, and 985 miles (1,585 km) of marine shoreline in Washington. Land ownership percentages for lands adjacent to the proposed critical habitat for the Coastal-Puget Sound population are approximately 32 percent Federal, 5 percent tribal, 7 percent State, and 57 percent private.

As described in more detail in Section 2.2, this analysis relies on fifth-field HUC watersheds to identify economic activities associated with bull trout conservation measures (Map 2).

1.7.2 JARBIDGE RIVER (UNIT 26)

The Jarbidge River Unit encompasses the Jarbidge and Bruneau River basins, which drain into the Snake River within C.J. Strike Reservoir upstream of Grand View, Idaho. The Jarbidge River Unit is located within Owyhee County in southwestern Idaho and Elko County in northeastern Nevada. The proposed critical habitat designation includes a total of approximately 131 miles (211 km) of streams in Idaho and Nevada. For the approximately 93 miles (150 km) of streams located in Nevada, the approximate land ownership percentages of adjacent lands are 92 percent Federal and 8 percent private. Adjacent land ownership percentages for the approximately 38 miles (62 km) of streams in Idaho are 93 percent Federal, 2 percent private, and 6 percent State. The Jarbidge River Unit consists of only one CHSU (Map 3).

1.7.3 SAINT MARY–BELLY RIVER (UNIT 29)

The Saint Mary-Belly River Unit is located in northwest Montana and comprised of two CHSUs, the Saint Mary River CHSU and the Belly River CHSU (Map 4). The proposed critical habitat designation for the Saint Mary-Belly River population includes approximately 88 miles (142 km) of streams and 6,295 acres (2,548 ha) of lakes in Montana. Land ownership percentages for the lands adjacent to proposed critical habitat are approximately 45 percent Federal (Glacier National Park), 45 percent tribal (Blackfeet Indian Tribe), and 10 percent private. The unit and all proposed critical habitat areas are located entirely within Glacier County, Montana.

1.7.4 A NOTE ABOUT CRITICAL HABITAT AND EFFECTS

The Service has identified proposed critical habitat as particular stream reaches in all three areas, lakes in all but the Jarbidge area, and nearshore marine areas in Washington. While most of the activities that may affect bull trout will likewise take place within these waterways, it is nevertheless possible that activities adjacent to or even some distance from the waterway could have an impact on bull trout or its habitat. In particular, activities such as timber harvesting or road construction could result in erosion and eventual depositing of sediment downstream.

In order to account for and include these activities in the economic analysis, while also providing sufficient detail on the area of impacts, a system of measure involving small watersheds was devised. The smallest geographic unit of analysis in proposed critical habitat units is the fifth-field Hydrologic Unit Code (HUC), which correspond to watersheds as defined by the USGS. This level of spatial resolution has been used in previous economic analyses of CHDs for other listed aquatic species.

The Service has investigated and is excluding from CHD those lands managed according to four existing HCPs: Washington Department of Natural Resources (WDNR), City of Seattle Cedar River Watershed, Tacoma Water, and Simpson Timber Company (Map 12). In addition, the Service has proposed to exclude from CHD lands of the Quinault Indian Reservation (Map 6), as well as lands covered by the Forest and Fish Report of 1999 (Map 11). These two categories of effects ("excluded" and "proposed for exclusion") will be identified separately from the proposed CHD.[42]

1.8 ORGANIZATION OF THE REPORT

The remainder of this report is divided into four sections. The next section describes the framework for analyzing the economic impacts associated with the designation of critical habitat for the bull trout in the three populations. This includes a description of the general analytic approach to estimating economic effects, operating definitions of retrospective and prospective effects, general categories of economic effects, and assumptions such as time frame of analysis and discount rate.

Each of the three populations – Coastal-Puget Sound, Jarbidge River, and Saint Mary-Belly River – examined in this report are presented in separate sections. All follow the same general outline. A profile of the region is followed by a discussion of the regulatory environment, and then the different categories of economic effects are examined. The categories of economic effects are organized by affected activity: for example, residential and commercial development, agriculture, and forest management. The specific categories addressed vary by population. The sections conclude with a summary of the findings and discussion of the results for the particular population of bull trout.

A number of appendices are included with this report. Appendix A addresses the economic effects of the proposed CHD on small entities and the nation's energy supply. Appendix B includes a presentation of the analytic framework for determining effects on residential and commercial development. Appendix C includes detailed estimates of the economic effects for the Coastal-Puget Sound population, and also provides the link between the proposed CHSUs and the fifth-field HUC watersheds used for economic analysis. Appendix D contains similar information for the Jarbidge River population. Appendix E includes a list of the acronyms used in the report. A Map Attachment is also provided and contains all maps referenced in the text of the report.

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[42] Note that the Service identified proposed CHD as "stream reaches," but identified "proposed for exclusion" and "excluded" areas as specific land areas. For the purpose of this analysis, we refer to them as lands.

1.8.1 CATEGORIES OF COSTS DELINEATED

Subsections that address specific categories of economic efficiency effects are organized in this report by the types of costs that are incurred. These types include:

- Section 7 Consultation Costs: These are costs incurred by Federal action agencies, the Service, and non-Federal agencies or private parties in consultation, and preparation of biological assessments and biological opinions. Consultation costs for agencies include both retrospective and prospective costs.

- Non-Section 7 Project Modification Costs: These are costs incurred by private entities associated with project modifications that are necessary to avoid incidental take of listed species. Both retrospective and prospective costs are addressed.

- Retrospective Costs: These are costs incurred by private or public entities (in addition to project modification costs) between the time of the bull trout listing and the CHD, and include the economic effects on private entities caused by restrictions to behavior or actions. Retrospective impacts include costs associated with *implementing* fish-related conservation activities between 1998 and 2004, even if the impetus for those activities was a Federal, State, or local regulation prior to 1998.

- Prospective or Forecasted Costs: These costs include future or anticipated economic effects on private or public entities (in addition to project modification costs) that would result from the listing or conservation activities associated with bull trout.

These types of economic effects are discussed in detail in Section 2.3. In addition to these efficiency effects, distributional effects and secondary impacts may also be associated with the costs identified above, particularly where there are costs borne by private sector. These are also discussed in Section 2.3.

This section describes the framework used in measuring the economic impacts associated with conservation actions to protect the Coastal-Puget Sound, Jarbidge River, and Saint Mary-Belly River populations of bull trout.[43] This section first describes the general concepts that underlie the estimation of economic effects associated with the proposed designation of critical habitat. This is done by taking into account the costs of conservation-related measures that are likely to be associated with future economic activities that may adversely affect the habitat within the proposed boundaries. These concepts include efficiency and distributional effects, as well as retrospective and prospective effects. Methods used to evaluate each of the different general categories of economic effects, such as efficiency effects on Federal or private entities, as well as distributional effects, are then described. The time frame and discount rate used in the analysis are also described, as well as general caveats and assumptions that apply to all categories of costs examined.

2.1 GEOGRAPHIC UNITS OF DESIGNATION AND ECONOMIC ANALYSIS

The Service proposed critical habitat in the form of specific stream reaches, which can be measured in terms of stream miles. The Service also identified accompanying geographic areas, which generally follow watershed boundaries, that encompass these stream reaches and refers to them as units (four in total) and CHSUs (26 in total). Map 1 highlights the two units and 23 CHSUs included in the Coastal-Puget Sound population. Maps 3 and 4 delineate similar boundaries for the Jarbidge River (one unit and one CHSU) and Saint Mary-Belly River (one unit and two CHSUs) populations.

For the purpose of economic analysis of proposed critical habitat, this report identifies economic activities and estimated effects on a more refined watershed scale. Map 2 identifies the specific boundaries for the economic analysis, which follows fifth-field HUC watersheds (i.e., smaller watersheds than those identified in the CHSU). For a given CHSU, this analysis is able to identify specific economic activities and effects within individual watersheds found within a CHSU.[44] This approach provides the Service with additional detailed information to support their decision-making process under section 4(b)(2).

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43 Much of the general framework discussion represents guidance from the Service and incorporates language employed in prior analyses of critical habitat designation.

44 In most cases, the watershed boundaries represented by fifth-field HUCs follow the same outer boundaries as the CHSUs. In a few rare cases, the boundaries do not overlap precisely, but costs are apportioned based on a reasonable set of assumptions (see Appendices C and D for specific information on apportioning fifth-field HUC impacts to CHSUs).

2.2 RETROSPECTIVE AND PROSPECTIVE EFFECTS

The economic analysis includes both retrospective and prospective effects. Retrospective effects include those costs that have accrued since the time the bull trout was listed as threatened but prior to designation of critical habitat. This retrospective analysis begins with the June 10, 1998, proposed rule listing the bull trout as threatened because this represents the first year in which economic impacts associated with section 7 consultations were initiated.[45] The retrospective period includes all of 2004 (i.e., a total of 6.5 years). Retrospective impacts include costs associated with *implementing* fish-related conservation activities between 1998 and 2004, even if the impetus for those activities was a Federal, State, or local regulation prior to 1998. Prospective impacts include likely future costs associated with bull trout conservation activities occurring between 2005 and 2024.[46]

As noted earlier, the geographic scope of the analysis for all three areas is the fifth-field HUC, or watershed. The purpose of a HUC level analysis is to provide the means for comparing relative prospective costs among designated streams within the context of its watershed. Retrospective costs are estimated and compiled for the entire area in aggregate, not by HUC. There are several reasons for using this approach. First, section 7 consultations have occurred within the range of the bull trout population in areas outside of the proposed critical habitat. By definition, HUCs outside of the CHD would not have prospective costs. To represent the Coastal-Puget Sound region for the purpose of the retrospective analysis, this analysis uses the boundaries of the 24 inclusive WRIA watersheds, which are generally equivalent to fourth-field HUCs. Second, conservation measures promulgated by Habitat Conservation Plans (see Section 3.2.2.2) were initiated as a result of the listing, but some costs occur within the geographic scope of the HCP that are excluded from proposed critical habitat. Although excluded from critical habitat, their bull trout-related effects will continue into the future on these non-CHD lands. In this analysis, these effects will be included as retrospective costs.[47]

The analysis of prospective costs focuses on economic activities occurring within fifth-field HUCs that contain stream reaches included in the proposed CHD (see Maps Attachments 2, 3, and 4 in the Map Attachment). This approach is based on the assumption that future section 7 consultations will occur only in HUC watersheds that are proposed as critical habitat, and will not occur in watersheds that do not support a designated stream reach. To the extent that future bull trout consultations occur in watersheds excluded from CHD, economic costs may be understated.

45 The Service database that tracks bull trout consultations contains entries starting in early 1998.

46 In the case of hydroelectric and non-hydroelectric projects, some capital costs are spread over 50 years. This is discussed in Section 3.4 “Effects on Hydroelectric Projects and Other Water Storage Dams.”

47 This approach to retrospective costs varies slightly by activity. For example, historic data on USACE-permitted activities such as dredging are available regarding the location of the activity. In these cases, costs are estimated for the watershed (i.e., HUC) where that consultation occurred. In other cases, the geographic boundaries for the retrospective analysis are more relevant, such as Federal lands management and forestland conservation activities where costs are apportioned on a per acre basis.

2.2.1 NEARSHORE MARINE HABITAT HUCS

Within the Coastal-Puget Sound population, there are 83 HUCs containing proposed critical habitat, and 20 of these include only the marine shoreline ("Nearshore Marine Habitat HUCs"). These HUCs are located in Puget Sound, along the western boundary of Hood Canal, along the northern coastline of the Olympic Peninsula adjacent to the Strait of Juan de Fuca, and on the coast of the Pacific Ocean. These HUCs are delineated in Map 5 of the Map Attachment. The treatment of prospective economic effects within these "nearshore marine habitat HUCs" is different from that of the HUCs containing designated stream reaches. Only costs associated with activities that are likely to affect the shoreline and marine areas, such as coastal development or dredging, are included in the analysis of prospective costs. Specifically, the analysis includes the following within the "nearshore marine habitat HUCs:"

- All USACE-permitted activities related to dredging and utilities and 50 percent of the estimated costs associated with instream activities. Due to limited information on the distribution of instream activities across marine and freshwater environments, the analysis assumes that half of them occur in the marine habitat environment;

- 25 percent of the residential and commercial development effects estimated in Section 3.3. This is based on two assumptions: (1) due to limited information on the distribution of developable acres within a particular "nearshore marine habitat HUC," the analysis assumes 50 percent of developments will be burdened by stormwater associated costs; and (2) due to uncertainty about the application of flow control requirements (and associated costs), this analysis assumes 50 percent of the stormwater costs are applied to the developable acres. Together, these assumptions result in a 75 percent reduction in the otherwise estimated residential and commercial development effects.

Inland activities, such as changes in forest management practices or road improvement projects, are not likely to result in costs that are attributable to the bull trout CHD, and therefore are not included in "nearshore marine habitat HUCs."

2.3 GENERAL CATEGORIES OF ECONOMIC EFFECTS

2.3.1 FEDERAL

Federal agencies incur costs that are directly attributable to compliance with the Act. As noted above, the Service is charged with enforcement, administration, consultation, and monitoring; these costs are predominantly programmatic, and some may be discernable as attributable to the bull trout listing. However, action agencies–those responsible for authorizing or carrying out projects or activities that could have an impact on an endangered species or its habitat–also incur costs through consultations, environmental studies, or necessary project modifications that can be directly or indirectly attributable to the bull trout conservation activities.

2.3.1.1 Section 7 Consultations, Technical Assistance, and Project Modifications

All Federal agencies are required by the Act to ensure the activities they authorize, fund, or carry out do not jeopardize a listed species or adversely modify or destroy designated critical habitat. Consultations may be formal or informal, but in either case the action agency incurs costs to interact with the Service. Costs include preparing Biological Assessments, meeting with Service staff to discuss project details, and implementing project modifications to avoid, minimize, or offset impacts to listed species. Federal agencies may also incur costs for monitoring habitat conditions.

Administrative costs of consultations, along with the costs of project modifications resulting from these consultations, represent compliance costs associated with the listing of the species and CHD. In this report, the number of consultations with the Service are identified and presented by action agency. The costs associated with compliance and project modifications are addressed, and administrative costs are included.

2.3.2 PRIVATE

The CHD for bull trout or any other endangered species has the potential to impose costs on private individuals or groups of individuals if there is a connection or nexus between private activities and Federal actions. For example, if a Federal permit is required before developers can begin construction or if there is Federal funding for a private activity, then it is possible that the provisions of the Act, including CHD, may potentially restrict private actions if the action results in a section 7 consultation.

This section identifies and briefly discusses some of the categories of economic activity that may occur in or near the proposed critical habitat areas. These categories include commercial and residential development, forestry, grazing, irrigation, recreation, mining, and others.

2.3.2.1 Framework for Residential and Commercial Development Effects

When critical habitat areas are designated in a region, developers may face the following three types of restrictions and costs: 1) development may be prohibited in riparian areas and near lakes, which will impose costs to developers and landowners; 2) development may be allowed in the designated areas, but developers in these areas are required to take additional on-site action to reduce sedimentation, protect forest cover, and manage stormwater; and/or 3) development may be allowed in the designated areas, but appropriate mitigation activities must be taken. The mitigation activities can be on-site or off-site. Thus, the impact of bull trout conservation activities on residential and commercial development may include the following components:

- Cost of development restrictions (e.g., prohibit development in riparian areas or near lakes and thus reduce the supply of developable land);

- Cost of project modifications and improvements (e.g., additional requirements for sedimentation reduction or stormwater management may be required); and

- Cost of mitigation activities for development (e.g., habitat restoration, land set-aside, and off-site conservation).

In this analysis, the costs to residential and commercial development arising from bull trout conservation activities for the Coastal-Puget Sound population are estimated based on the assumption that development is allowed in the designated areas if appropriate stormwater management requirements are implemented; i.e., no land is removed from potential development as a result of development restrictions. This assumption is based on the historical consultation record, which indicates (1) very few section 7 consultations regarding development have occurred;[48] (2) those that have occurred generally resulted in the recommendation to follow the Washington Department of Ecology's (WDOE) Stormwater Management Manual to mitigate water quantity and quality impacts; and (3) those that have occurred do not specifically cite land set asides or other off-site habitat restoration actions as recommended conservation measures to protect bull trout.

The stormwater management manual was updated in 2001 in part as a result of species listings under the Act. The update includes changes in threshold levels for selection of Best Management Practices, increased flow control requirements, and a requirement for enhanced treatment of discharges. Thus, of the three cost components, only the second one is relevant for this analysis. The methods for calculating this component are discussed below. The methods for calculation of all three components of cost are discussed in Appendix B.

In 2005, WDOE plans to finalize updates to the stormwater management manual. Although revisions are still underway at the time of this analysis, it appears that the following changes represent the most significant revisions related to residential and commercial development that are likely to occur:[49]

- Proposing to exclude from flow control requirements discharges to certain listed water bodies in Western Washington.[50] That is, flow control requirements on development sites for which the natural discharge location would result in flow entering the listed water bodies, would be exempted (though treatment and other controls would remain).

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48 Consultations on development and construction resulting from a Federal nexus generally result when Federal funding is provided for a project through HUD or the BIA. In other cases, a section 7 consultation may result if a residential or commercial development requires a USACE section 404 permit under the CWA.

49 Personal communication with Ed O'Brien, Washington Department of Ecology, February 1, 2005. Information regarding proposed Stormwater Management Manual revisions is also available at http://www.ecy.wa.gov/programs/wq/stormwater/WW%20Stormwater%20Manual/Manual_update_changes.htm.

50 The list of waterbodies was developed based on criteria regarding the size of the watershed and its ability to absorb additional stormwater runoff. The Washington State list is available at http://www.wsdot.wa.gov/environment/wqec/docs/TC_PostPub_HRM_Table2.5_120604.pdf.

- Proposing to revise the existing flow control baseline "forested landscape" to allow potential developers to meet a baseline condition that varies by site characteristics. That is, for a development project proposed on a site with 50 percent impervious surface layer, the developer would now be required to return the site to a condition similar to 50 percent impervious surface layer.

In general, these revisions tend to reduce the requirements for stormwater mitigation measures, leading to potential cost savings for developers. In particular, the proposed list of exempted water bodies includes a number of major rivers included as part of the proposed bull trout critical habitat including, but not limited to, the Nooksack, Skagit, Stillaguamish, Snohomish, Skykomish, Puyallup, Nisqually, Quinault, Queets, Hoh, and Dungeness rivers.

However, this analysis assumes that these revised requirements will not significantly change the conservation measures requested by the Service and therefore are unlikely to affect our cost estimates based on the incremental costs associated with the 2001 Stormwater Management Manual. This assumption is based on comment provided by the Service (and NOAA Fisheries) to WDOE in December 2004 in which the Service expressed their concern over the impact of these revisions on listed fish and wildlife species. In their comments, both agencies recommended that WDOE pursue additional studies and consider the application of low impact development strategies before adopting these revisions.[51] In addition, Service biologists indicate that in future consultations, they are likely to request adherence to the 2001 stormwater management requirements in order to ensure protection of bull trout.[52]

Cost of Project Modifications and Improvements

The net present value approach is used to measure the cost of project modifications and improvements associated with designation of critical habitat. This approach allows us to estimate the cost by different types of development (commercial, residential, or mixed development) and by region (e.g., a particular HUC). The framework requires several pieces of information, including: a) projected acres of each type of development in each HUC within the area designated for critical habitat, b) percent of development actually "burdened" by the requirements, and c) per-acre costs of project modification for the "burdened" development. With these data, the prospective cost of critical habitat designation for commercial and residential development during a given time period (e.g., from 2005 to 2025) can be estimated by the following formula, where total cost (TC) is measured in 2004 dollars:

$$TC = \sum_{t=2005}^{2025} \sum_{i=1}^{I} \frac{A_t^i S_t^i C_t^i}{(1+r)^{t-2005}} \tag{1}$$

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51 Berg, Ken S., and Steven W. Landino, December 23, 2004, Joint Letter from U.S. Fish and Wildlife Service and NOAA Fisheries to Ed O'Brien, Washington Department of Ecology.

52 Personal communication with Service Biologist, Western Washington Fish and Wildlife Office, Lacey, Washington, February 2, 2005.

$i =$ types of development (low-density residential, high-density residential, 1-acre commercial, 10-acre commercial, mixed development, etc.)

A_t^i = projected acres of type i development in year t

S_t^i = percent of type-i development actually burdened

C_t^i = per-acre or per unit project modification cost

$r =$ discount rate

Likewise, the retrospective cost of habitat designation for commercial and residential development during a given time period (e.g., from 1998 to 2004) can be estimated by the following formula, where the retrospective cost is also measured in 2004 dollars:

$$(2) \qquad TC = \sum_{t=1998}^{2004} \sum_{i=1}^{I} [A_t^i S_t^i C_t^i (1+r)^{2004-t}]$$

Project Delays and Regulatory Uncertainty

In addition to direct costs of consultation and project modification associated with bull trout conservation activities, the analysis considers potential indirect impacts, such as may result from project delays. Both public and private entities may experience incremental time delays for projects and other activities due to requirements associated with the section 7 consultation process and/or compliance with other laws associated with the designation. The need to conduct a section 7 consultation will not necessarily delay a project, as often the consultation may be coordinated with the existing regulatory approval process. However, depending on the schedule of the consultation, a project may experience additional delays, resulting in an unanticipated extension in the time needed to fully realize returns from the planned activity. Delays of this nature were considered in the development of this analysis and it was determined that they may result in an impact that is not likely to materially change the quantitative results of this analysis.

Stigma Effects

Stigma refers to the change in economic value of a particular project or activity due to negative (or positive) perceptions of the role critical habitat will play in developing, implementing, or conducting that policy. For example, "stigma effects" include changes to private property values associated with public attitudes about the limits and costs of implementing a project in critical habitat. Stigma effects are a form of uncertainty that relate more to perceived fluctuations rather than observation, when there is limited information on actual outcomes. However, there is a void of peer-reviewed literature that has successfully identified or attempted to quantify empirical estimates of stigma effects. As such, while this analysis recognizes the potential for a small portion of developable land is subject to a short-term stigma effect because of uncertain regulatory requirements, no attempt is made to estimate its magnitude.

2.3.2.2 Framework for Effects on Forest Management Practices

Both past and current forest practices are listed as a concern for bull trout recovery in the recovery plans for the Olympic Peninsula and Puget Sound units that make up the Coastal-Puget Sound population. Timber harvest and associated road building have resulted in degraded water quality and flows in some watersheds. To assess the impacts associated with forest management practices, including timber harvest and road building and decommissioning, this report considers the economic impacts associated with fish-related conservation activities and, where possible, quantifies the retrospective impact (since 1998) and the future impact through 2024. Fish-related conservation activities that are implemented on Federal lands are identified through a review of past section 7 consultations with the USFS, including consideration of the Northwest Forest Plan. Similar fish-related conservation activities on private land are identified through the review of recent revisions to the Washington State Forest Practice Rules (FPR)—primarily driven by the Forest and Fish Report of 1999. The assessment of private land includes both HCP and non-HCP timber lands.[53] For the purposes of this analysis, fish-related conservation activities include actions taken primarily to benefit fish species (e.g., protection of riparian zones, road repair and reconstruction designed to reduce sedimentation, etc.) and, in general, does not include actions or project modifications designed specifically for upland species (e.g., preservation of old growth timber stands for the spotted owl). Inevitably, fish-related conversation activities provide benefits to species other than bull trout.

To quantify economic effects on Federal land, this analysis considers the cost of implementing measures associated with timber sales on Federal land. To quantify effects on private land, previous economic analysis of the recently revised FPR that considers the opportunity costs associated with foregone timber sales were reviewed. For both Federal and private land, this analysis develops per acre costs associated with compliance and applies that cost to the number of acres within each HUC.

2.3.2.3 Framework for Effects on Agriculture

Impacts to irrigated agriculture may occur in the Coastal-Puget Sound and Saint Mary-Belly River critical habitat areas. Irrigated agriculture in the Coastal-Puget Sound bull trout critical habitat area overlaps with previously proposed critical habitat for salmon and steelhead and it is not expected that bull trout will impose significant additional costs to this sector.[54] For example, modifications to irrigation diversions

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53 As discussed in more detail in Section 3.2.2.2, this analysis estimates the economic impact of timber harvest-related conservation measures identified in HCPs, but does not include the cost of HCP development as an economic impact attributable to the protection of bull trout.

54 NOAA Fisheries is responsible for critical habitat designation for threatened and endangered anadromous fish species. An April 30, 2002, court order vacated the CHD for 19 "evolutionarily significant units" (ESUs), including two ESUs overlapping with bull trout proposed CHD in the Coastal-Puget Sound.

from the Dungeness River and instream flow water purchases are currently in various stages of development in order to address salmon and steelhead concerns. Nevertheless, these activities provide benefit to bull trout species. Therefore, this analysis examines impacts to agriculture where there is a Federal nexus (e.g., a USBR project) wherever it may occur in the critical habitat and attribute the costs accordingly. Agricultural costs are obtained from both recent site-specific studies conducted by NEA and its subcontractors as well as more general analyses found in the water valuation literature.

For the Saint Mary-Belly River population, it is possible that conservation efforts for bull trout will require capital modifications and impose operational changes on the major diversion and inter-basin transfer from the Saint Mary River supplying the USBR Milk River Project. Capital project requirements and changes in water supply to the irrigation project are determined through conversations with USBR staff. An agricultural production model and input-output analysis are used to estimate the economic impacts of these changes. The economic impacts of water right purchases for instream flow augmentation are also assessed where it is evident that such actions have been or will be undertaken for protection of bull trout.

It should also be noted that a water rights compact in the Milk River basin has been negotiated and it is anticipated that the compact will be presented to Congress for approval in the near future. This compact may result in changes in both timing and quantity of water diverted from the Saint Mary River. As a consequence, the analysis of bull trout conservation efforts assumes that the compact is in effect.

2.3.2.4 Framework for Effects on Livestock Grazing

The bull trout conservation activities in the Jarbidge River population may impact livestock grazing activities in the region by restricting grazing on land adjacent to riparian areas. The restricted area and associated productivity are identified through interviews with BLM and USFS staff and measured using GIS coverages. The economic importance of restricted areas is estimated by describing the current grazing use in the affected areas and estimated contributions to livestock returns. If there is a reduction in animal unit months (AUMs) due to bull trout conservation activities, this is estimated and compared to the use prior to the designation. The potential economic impacts are estimated using the additional costs incurred by livestock producers in securing alternative feed sources to mitigate for the reduced AUMs of grazing. In addition, increased management costs associated with off-stream watering and riparian fencing requirements are assessed.

2.3.2.5 Framework for Effects on Mining

Mining has been identified as having had a past role in the decline in bull trout populations. Mining activities could be restricted to varying degrees depending upon the affected area. For the Saint Mary and Belly River population, most of the mining activity affecting bull trout occurs downstream in Canada, outside of the Act’s jurisdiction. Mining activity in the Jarbidge River basin was fairly extensive in the past but has waned, and the costs appear to be limited to the control of effluent from abandoned mines. The extent of additional mining related effects is explored in the analysis.

Recreational and suction mining in the upper basins within the Coastal-Puget Sound critical habitat area can have significant, but site specific, effects on bull trout. Restrictions on such activity are determined through discussions with the USFS, and identification of sites from U.S. Army Corps of Engineers (USACE) dredge permits and U.S. Geological Survey of mining sites.

2.3.2.6 Framework for Effects on Transportation Networks

Extensive transportation networks exist within the Coastal-Puget Sound critical habitat area and have been identified as a limiting factor to bull trout recovery. Required actions may include moving roads and additional road maintenance. The unit costs of required modifications are estimated through a review of existing reports and through conversations with the respective state department of transportation staff. These unit costs are then applied to the number of modifications in each unit estimated through available GIS coverages.

Although there are very few roads in the Jarbidge River critical habitat area, road improvement and options for road construction in the Jarbidge River Canyon have been identified as having an impact on bull trout habitat. This analysis estimates costs using a Draft Environmental Impact Statement for the South Canyon Road, and determining the incremental costs of the preferred or selected alternative that may be attributable to bull trout conservation.

2.3.2.7 Framework for Effects on Dredging, Utilities, and Instream Activities

The U.S. Army Corps of Engineers is responsible for permits under Section 404 of the Clean Water Act, or Section 10 River and Harbors Act. Utility projects generally include work related to pipelines and other utility lines (e.g., telephone) and associated outfall structures. Common activities include excavation, backfilling, and restoration of the work site. When these projects occur within or proximate to water bodies, they generally require a Section 404 or Section 10 permit. In addition to dredging and utility projects, permits are required for a variety of other activities that affect waterways. These projects include construction and repair of piers, boat ramps, pilings, as well as bank stabilization and fill activities, among others.[55]

The effects on these activities were examined using the Corps of Engineers database of permits. Past permits are available in a GIS coverage which allows a spatial analysis by HUC. The costs are estimated using the annual number of applicable permits and deriving an estimate of average annual costs that are likely over the prospective period.

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[55] A comment on the draft version of this analysis received from Washington State Ferries inquired about the impact of bull trout conservation efforts specifically on marine transportation systems and associated construction and maintenance activities. As detailed in Section 3.1.2 below, this economic analysis captures costs associated with marine transportation systems within the category called "Instream Activities." Within this category of activities, the analysis projects future costs associated with USACE permitting of the following types of activities: Ferry Terminal, Boat Ramp, Pier, and Pile.

2.3.3 SECONDARY AND REGIONAL IMPACTS

Regional economic impact analysis can provide an assessment of the potential localized effects of conservation activities. Specifically, regional economic impact analysis produces a quantitative estimate of the potential magnitude of the initial change in the regional economy resulting from a regulatory action. Regional economic impacts are commonly measured using regional input/output models, such as those created using IMPLAN modeling software and databases. These models rely on multipliers that mathematically represent the relationship between a change in one sector of the economy (e.g., expenditures by recreationists) and the effect of that change on economic output, income, or employment in other local industries (e.g., suppliers of goods and services to recreationists). These economic data provide a quantitative estimate of the magnitude of shifts of jobs and revenues in the local economy. These additional impacts are referred to as "secondary impacts."

The use of regional input/output models in an analysis of the impacts of species and habitat conservation efforts can overstate the long-term impacts of a regulatory change. Most importantly, these models provide a static view of the economy of a region. That is, they measure the initial impact of a regulatory change on an economy but do not consider long-term adjustments that the economy will make in response to this change. For example, these models provide estimates of the number of jobs lost as a result of a regulatory change, but do not consider re-employment of these individuals over time or other adaptive responses by impacted businesses. In addition, the flow of goods and services across the regional boundaries defined in the model may change as a result of the regulation, compensating for a potential decrease in economic activity within the region.

Despite these and other limitations, in certain circumstances regional economic impact analysis may provide useful information about the scale and scope of localized impacts. This is the case in this analysis when considering, for example, the effects on agriculture related to changes in water supply. It is important to remember that measures of regional economic effects generally reflect shifts in resource use rather than efficiency losses. Thus, these types of secondary impacts are reported separately from efficiency effects (i.e., not summed). In addition, measures of regional economic impact cannot be compared with estimates of efficiency effects, but should be considered as distinct measures of impact.

In this report, secondary and regional impacts are not measured for every activity analyzed. They are addressed specifically when there is a projected efficiency change, or reduction in level of output, associated with bull trout conservation activities.

2.3.4 EFFECTS ON SMALL ENTITIES

This analysis considers how small entities, including small businesses, organizations, and governments, might be affected by future bull trout conservation activities. The analysis follows guidelines appropriate for the Regulatory Flexibility Act (RFA).[56] Those activities involving small entities are identified, affected small entities described, and potential effects estimated, depending on the availability of data. This analysis is included in Appendix A of this report.

2.3.5 Effects on Energy Supply

In adherence with Executive Order 13211, "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use," the analysis considers the future impacts of conservation activities on the energy industry and its customers.[57] This involves analyzing impacts associated with changes in existing or proposed energy generating facilities as a result of the CHD. If the proposed designation results in a reduction of more than 500 megawatts of installed capacity, the potential electricity price impacts are also considered. This analysis is included in Appendix A of this report.

2.4 Project Life, Period of Analysis, and Discount Rate

The period of analysis and discounting is guided by the availability of information concerning the start date and duration of the activity. Each potential cost component has a time period that is appropriate for that specific activity or investment. The time period used is therefore discussed in each section describing the effects of individual types of activities. For example, in evaluating the effects of conservation activities on residential and commercial property, a time frame of 20 years was used to reflect the useful life of storm drain and other modifications to such construction.

The time frame associated with each activity is important because as the time horizon for an economic analysis is expanded, the forecast of future projects becomes increasingly speculative. As a result, with the exception of hydroelectric and non-hydroelectric projects where some capital costs are spread over 50 years, this analysis relies primarily on a time frame of 20 years. The time frame for hydroelectric and non-hydroelectric projects is longer relative to other activities analyzed based on the nature of the activity. Whereas geographic and total projections of population and housing densities within a region become increasingly speculative over time, the known location and inevitability of hydroelectric dam re-licensing or other permitting provides sufficient information to estimate future costs associated with conservation measures at these facilities.

Some costs are recurring while others are one time costs. These costs are presented both as net present values and as annualized costs. The total cost per unit of designated habitat represents the summation of annual costs obtained for each of the component economic impacts. Prospective (future) costs are estimated using both a seven percent and three percent discount rate.

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[56] 5 U.S.C. § 601 *et seq*.

[57] Executive Order 13211, May 18, 2001 "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use."

2.5 CAVEATS AND ASSUMPTIONS

The assumptions presented here include only those which in general apply to all areas included in the analysis. Similar information on assumptions and possible bias that apply specifically to individual populations appears later in the report, within the particular section related to the relevant CHD area.

These general caveats, and those presented later relevant to each population, describe factors that introduce uncertainty into the results of this analysis. Table 1 contains a summary of these key assumptions. These caveats and assumptions may be revised as additional information becomes available. The Service therefore solicits from the public further information on any of the issues presented in the discussions and tables of caveats. Additionally, information pertaining to the following questions is requested.

1. Are data available to develop more accurate estimates of the number of future consultations, project modifications, and costs for the activities related to private lands?
2. Are data available on additional land use practices, or current or planned activities in proposed critical habitat areas, that are not specifically or adequately addressed in this analysis?
3. Are data available on additional co-extensive impacts (such as additional regulatory burdens from State or local laws triggered by the designation of critical habitat) that are not specifically or adequately addressed in this analysis?

Table 1
Assumptions and Uncertainties Applicable to the General Analysis[a/]

Assumption	Direction of Bias
The analysis considers the cost of conservation and protection activities for the bull trout including those attributable to the listing, to CHD, or other state and local regulations.	+/-
The analysis focuses on economic activities occurring within fifth-field HUC watersheds that contain stream reaches proposed for CHD. Although the Service proposes to exclude from the designation certain lands already covered by existing management, this does not affect the estimation of costs associated with conservation activities for the bull trout.	+
The HUC level analysis includes aquatic reaches identified as critical habitat as well as adjacent land beyond the boundaries of the designated stream reaches where the potential to effect the constituent elements of critical habitat are likely. Thus, all relevant costs in adjacent areas may be included.	+
Inevitably, actions taken to protect bull trout provide benefits to other salmon species. When conservation activities are implemented in areas of habitat overlap between listed salmon and bull trout, the analysis attributes the costs of the fish-related conservation activities co-extensively to both species.	+
The prospective portion of this analysis assumes that the Service will consult on future Federally-authorized activities that occur only within the areas proposed for critical habitat. As such, the analysis assumes no consultations will occur outside of the watersheds containing critical habitat.	+

Assumption	Direction of Bias
Non-market benefits are not easily measured without additional resources, unless directly applicable and peer-reviewed analyses are readily available. Consequently, this analysis makes no attempt to measure the positive social welfare effects that may be associated co-extensively with CHD.	+

+: This assumption is likely to produce an upward bias in cost estimates.
-: This assumption is likely to produce a downward bias in cost estimates.
+/-: No direction of bias can be determined.
[a/] This table summarizes general caveats and assumptions related to the approach of the analysis. Detailed caveats and assumptions are described under relevant sections for each analyzed activity.

2.5.1 COASTAL-PUGET SOUND: DISTRIBUTION OF ECONOMIC EFFECTS AMONG LISTED SPECIES

As discussed below in Section 3.2.1, there are several salmonid species that are listed as threatened, or are candidates for listing under the Act, whose ranges overlap the proposed CHD for the Coastal-Puget Sound population of bull trout. Conservation activities designed to protect bull trout may provide coincident protection to other fish species, particularly salmon and steelhead. Conversely, conservation activities designed specifically for salmon provide coincident protection to bull trout. Estimating the economic effects of bull trout conservation by including the total cost of all actions driven by a general goal of fish habitat improvement would likely overstate the economic costs of the bull trout CHD. Similarly, including the costs of conservation actions driven only by bull trout, while ignoring the beneficial effects (and costs) of salmon habitat conservation efforts in overlapping watersheds, would likely understate the economic costs of bull trout conservation. To address this issue, this analysis reflects the following considerations:

- **Determine location of activity**. For activities that occur in fifth-field HUC watersheds that support proposed bull trout critical habitat outside of previously listed salmon ESUs, this analysis attributes the full cost of activities to bull trout. For activities that occur in watersheds that overlap with the previously delineated ESU boundaries for salmon, this analysis considers the timing, impetus, and distribution of the conservation activities.[58]

- **Timing**. For activities for which the conservation activities were undertaken prior to 1998 (the date of proposed listing of bull trout), and which were directed primarily for the protection of salmon or steelhead populations, the analysis attributes no economic costs to bull trout protection.

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[58] To identify HUC watersheds that support salmon, the analysis relies on an assessment of the Puget Sound Chinook salmon population conducted by NOAA Fisheries Puget Sound Technical Recovery Team (note that the watersheds supporting Puget Sound Chinook are inclusive of those supporting Hood Canal Summer-Run chum). Their findings regarding the specific fifth-field HUC watersheds supporting 22 independent Chinook populations are detailed in the report, *Initial Assessment of NOAA Fisheries' Critical Habitat Analytical Review Teams For 13 Evolutionarily Significant Units of Pacific Salmon and O. mykiss* (November 2004).

- **Impetus.** For activities initiated after 1998 but which were driven exclusively by salmon protection concerns, no economic costs are attributed to bull trout. For example, fish protection measures undertaken at diversion dams within the City of Seattle HCP (Cedar River) were designed specifically for the protection of downstream salmon. Costs in this case are not attributed to bull trout protection.

- **Cost Apportionment.** In assigning costs for fish-related conservation activities in watersheds that support both previously listed salmon species and the proposed bull trout CHD, this analysis assumes that the economic effect of fish-related conservation measures *is attributed co-extensively to both species*. That is, where a conservation activity provides indivisible benefits to both species in an overlapping watershed, the cost of the activity is apportioned to both species as "Impacts Associated with Co-Extensive Salmon and Bull Trout Conservation Activities." In HUCs where proposed critical habitat for the bull trout does not overlap with the range of other listed species, the cost impact assessment follows the basic analytic framework described above.

2.6 Economic Analysis of Bull Trout I: A Comparison of Approaches

This section discusses the differences between the economic analyses of two components of a proposed rule associated with critical habitat for bull trout: the Columbia/Klamath Population of bull trout (proposed in November 2002) and the Coastal-Puget Sound, Jarbidge River, and Saint Mary-Belly River populations of bull trout (proposed in June 2004 and the subject of this analysis).

An analysis of economic impacts associated with the designation of critical habitat for the Columbia River and Klamath River populations of bull trout ("Bull Trout I") was completed by Bioeconomics, Inc., in September 2004.[59] The Columbia/Klamath economic analysis (EA) was based on the critical habitat area described in the proposed rule,[60] consisting of 18,471 river miles and 532,721 acres of lake and reservoir habitat within 25 units.[61] Total costs associated with both listing and CHD for the bull trout are forecast to be $200 to $260 million over the next ten years, with costs for the Klamath population of $5.3 to $7.3 million and for the Columbia population of $195 to $253 million over the next ten years.

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59 Bioeconomics, Inc., September 2004, *Final Economic Analysis of Critical Habitat Designation for the Bull Trout*, prepared for U.S. Fish and Wildlife Service.

60 U.S. Fish and Wildlife Service, November 29, 2002, "Proposed Designation of Critical Habitat for the Klamath River and Columbia River Distinct Population Segments of Bull Trout and Notice of Availability of the Draft Recovery Plan, Proposed Rule and Notice," *Federal Register*, Vol. 67, No. 230, pp. 71235-71438.

61 The Service excluded some proposed areas from the final designation for the Columbia and Klamath populations of bull trout, and released an addendum to the economic analysis that incorporated these changes in the cost estimates; however, this discussion relates to the final economic analysis based on the proposed designation.

The Columbia/Klamath EA differed in several ways from this current EA for the Coastal-Puget Sound, Jarbidge River, and Saint Mary-Belly River populations of bull trout. The general differences in approach and assumptions are described here.

A ten year prospective time frame is used in the Columbia/Klamath EA, beginning with the date the proposed rule designating critical habitat became available to the public, November 30, 2002. The current EA primarily uses a 20 year time frame for the prospective analysis,[62] beginning with the release of the proposed rule for the three subject populations in 2004. The time frame for analysis was selected to emulate a reasonable future period for recovery of the species, and availability of future population projections in the Coastal-Puget Sound region.

The allocation of project modification costs among bull trout and other listed species is handled differently in the two reports. For the Columbia/Klamath EA, the cost allocation varies with the agency and project, as described in Exhibit ES.7 of the report. Costs related to the USACE and Upper Willamette River dams and reservoirs are allocated equally among salmon, steelhead, and bull trout; i.e., one-third of estimated costs are allocated to bull trout. Project modification costs for BPA and the Federal Columbia River power system are allocated fully to bull trout. A little more than 40 percent of total fishery-related costs associated with FERC relicensing are allocated to bull trout, with five percent specifically to bull trout section 7 consultations. For USFS activities, all costs are allocated to species other than bull trout; i.e., no costs are allocated to bull trout.

This analysis, however, has allocated costs in a somewhat different manner. First, salmon species listed as threatened overlap with the geographic area of the Coastal-Puget Sound population of bull trout. There are no listed species of salmon or steelhead in the Jarbidge River or Saint Mary-Belly River populations. Second, in cases where there is an overlap of range between salmon and bull trout, no separation is made of these joint costs, and they are presented as "impacts associated with co-extensive of salmon and bull trout conservation activities."

A key difference between the two reports also stems from the difference in the critical habitat areas themselves. Table 2 provides an overview of the proposed critical habitat areas for the different populations, and the adjacent land ownership. For the Columbia and Klamath populations, the majority of the adjacent lands are in Federal ownership. However, for the Coastal-Puget Sound population, under one-third of the adjacent lands are Federally owned; the majority (57 percent) are in private ownership.

The Columbia/Klamath EA mentions the considerable portion of lands in Federal ownership and the location of proposed critical habitat areas in "sparsely populated headwaters away from large urban

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62 In the case of hydroelectric and non-hydroelectric projects, some capital costs are spread over 50 years. This is discussed in Section 3.4 "Effects on Hydroelectric Projects and Other Water Storage Dams."

centers" as justification for finding little impact on residential development.[63] This analysis, however, asserts a likelihood of residential development impacts in the Coastal-Puget Sound population based in part on the greater proportion of private lands adjacent to proposed critical habitat, and the location of much of the critical habitat areas in highly urban or semi-urban areas.

The proposed rule for the Columbia and Klamath populations of bull trout included a substantial amount of unoccupied areas. Approximately 2,531 miles of streams and 30,075 acres of lakes and reservoirs included in the proposed designation[64] were determined to be essential to the conservation of bull trout, but not known to be occupied.[65] The proposed CHD for the Coastal-Puget Sound, Jarbidge River, and Saint Mary-Belly River populations of bull trout, however, only includes known occupied areas within the proposed designation of critical habitat.

Table 2
Comparison of Geographic Characteristics of Proposed CHD for Bull Trout

	Population of Bull Trout:				
	Columbia River	**Klamath River**	**Coastal-Puget Sound**	**Jarbidge River**	**Saint Mary-Belly River**
Proposed CHD:					
Streams (miles)	18,175	296	2,290	131	88
Lakes/Reservoirs (acres)	498,782	33,939	52,540	n/a	6,295
Marine Shoreline (miles)	n/a	n/a	985	n/a	n/a
Adjacent Land Ownership:					
Federal	58%	55%	32%	92%	45%
Tribal	2%	n/a	5%	n/a	45%
Local/State	4%	n/a	6%	3%	n/a
Private	36%	45%	57%	5%	10%

Source: U.S. Fish and Wildlife Service, November 29, 2002, "Proposed Designation of Critical Habitat for the Klamath River and Columbia River Distinct Population Segments of Bull Trout and Notice of Availability of the Draft Recovery Plan, Proposed Rule and Notice," *Federal Register*, Vol. 67, No. 230, pp. 71247-71248; and U.S. Fish and Wildlife, June 25, 2004, "Proposed Designation of Critical Habitat for the

63 Bioeconomics, Inc., September 2004, *Final Economic Analysis of Critical Habitat Designation for the Bull Trout*, prepared for U.S. Fish and Wildlife Service, p. 3-29.

64 U.S. Fish and Wildlife Service, November 29, 2002, "Proposed Designation of Critical Habitat for the Klamath River and Columbia River Distinct Population Segments of Bull Trout and Notice of Availability of the Draft Recovery Plan, Proposed Rule and Notice," *Federal Register*, Vol. 67, No. 230, p. 71243.

65 The final rule for the Columbia and Klamath populations of bull trout reduced significantly the miles of stream and acres of lakes and reservoirs originally proposed for designation as critical habitat. Note, however, that the economic analysis conducted by Bioeconomics, Inc., was based on the characteristics of the *proposed*, not *final*, designation (see U.S. Fish and Wildlife Service, October 6, 2004, "Designation of Critical Habitat for the Klamath River and Columbia River Populations of Bull Trout, Final Rule," *Federal Register*, Vol. 69, No. 193, pp. 59996-60076).

Jarbidge River, Coastal-Puget Sound, and Saint Mary-Belly River Populations of Bull Trout, Proposed Rule," *Federal Register,* Vol. 69, No. 122, pp. 35783-35784.

3.1 SOCIOECONOMIC PROFILE OF THE CRITICAL HABITAT AREA

Key economic and demographic information, including population characteristics and general economic activity, for the counties included in the proposed CHD for the Coastal-Puget Sound population of bull trout is presented in this subsection. The smallest area for which socioeconomic data are available most reliably is at the county level, so county data are presented in order to provide context for the discussion of potential economic impacts later in this report. The county data also serves to illuminate trends within the CHD that could influence the potential economic impacts, and therefore aid in the analysis of those impacts. Although county level data may not precisely reflect the socioeconomic characteristics of the areas immediately surrounding the proposed CHD for the Coastal-Puget Sound population of bull trout, these data provide the best context for the broader analysis.

3.1.1 LOCATION AND GEOGRAPHY OF THE COASTAL-PUGET SOUND REGION

The Coastal-Puget Sound population of bull trout occupies an area of northwestern Washington that is divided into two units: Olympic Peninsula River Basins Unit and the Puget Sound River Basins Unit (Map 1). The Olympic Peninsula Unit is relatively isolated as it is bordered on three sides by water. The Pacific Ocean to the west, Strait of Juan de Fuca to the north, and the Hood Canal to the east serve as boundaries to the unit, with the Chehalis River forming much of the southern boundary. The Olympic Mountains comprise the central portion of the Olympic Peninsula, and high elevation ridges radiate from the interior mountains to form the boundaries of the major river basins. All of the major river basins initiate from the Olympic Mountains. Elevations range from sea level to 7,962 feet (2,462 m) at Mount Olympus. The Olympic Peninsula Unit covers an area of approximately 6.5 million acres (2.6 million ha) and extends across portions of Grays Harbor, Clallam, Mason, Pacific, and Jefferson counties.

The Puget Sound Unit encompasses the geographic area of the Puget Sound region and includes all watersheds within the Puget Sound basin and the marine nearshore areas of Puget Sound. The area is bordered by the Cascade crest to the east, Puget Sound to the west, the Lower Columbia and Olympic Peninsula Units to the south, and the U.S.-Canada border to the north. The Puget Sound Unit covers an area of approximately 8.4 million acres (3.4 million ha) and extends across portions of Whatcom, Skagit, Snohomish, King, Pierce, Thurston, and Island counties. The major river basins within the unit initiate from the Cascade Mountain Range and flow west to discharge into Puget Sound, with the exception of the Chilliwack River system, which flows northwest into British Columbia, Canada, and discharges into the Fraser River.

3.1.2 Population Characteristics and Demographics

The proposed CHD spans 12 counties within the State of Washington. Table 3 presents the population size, change in population from 1990 to 2000, per capita income, and poverty rates for the individual counties with CHD within their boundaries, and the State of Washington as a whole. The 12 counties containing CHD together account for about 65 percent of the total population of the State, or nearly four million people. Almost half of the total population of the 12 counties is found in King County, the most populated county of the State, with nearly 1.8 million people, or 29 percent of State's total population. The next largest county with CHD within its boundaries is Pierce County, with 740,957 people. Pacific County, with a 2003 population of 21,103, is the smallest among the twelve counties.

Table 3
Socioeconomic Profile of Counties Containing Proposed Critical Habitat for the Coastal-Puget Sound Population of Bull Trout

County/State	Population (2003)	Percent of State (2003)	Change (1990-2000)	Per Capita Income (2001)	Poverty Rate (2000)
Clallam County	66,892	1.1%	+14.3%	$25,596	12.1%
Grays Harbor County	69,406	1.1%	+4.7%	$22,299	15.0%
Island County	76,384	1.2%	+18.9%	$28,112	7.6%
Jefferson County	27,716	0.5%	+28.8%	$28,850	10.7%
King County	1,761,411	28.7%	+15.2%	$45,965	7.2%
Mason County	52,129	0.9%	+28.9%	$21,610	12.2%
Pacific County	21,103	0.3%	+11.1%	$21,533	14.8%
Pierce County	740,957	12.1%	+19.6%	$26,601	9.5%
Skagit County	109,234	1.8%	+29.4%	$27,574	10.5%
Snohomish County	639,409	10.4%	+30.1%	$29,460	7.1%
Thurston County	221,950	3.6%	+28.6%	$28,266	8.6%
Whatcom County	176,571	2.9%	+30.5%	$24,564	11.4%
Washington State	**6,131,445**	**100.0%**	**+21.1%**	**$31,976**	**9.6%**

Sources:
2003 population estimates: U.S. Census Bureau, "Annual Population Estimates 2000-2003," downloaded from http://eire.census.gov/popest/data/counties/CO-EST2003-01.php, May 11, 2004.
2000 poverty estimates: U.S. Census Bureau, "Small Area Income and Poverty Estimates," downloaded from http://www.census.gov/hhes/www/saipe/estimatetoc.html, May 12, 2004.
1990-2000 population change: U.S. Census Bureau, "Ranking Tables for Counties," downloaded from http://www.census.gov/population/www/cen2000/phc-t4.html, May 12, 2004.
2001 per capita income: U.S. Department of Commerce, Bureau of Economic Analysis, May 2003, *Regional Economic Information System 1969-2001*, CD-ROM.

All of the 12 counties experienced population growth to a varying degree between the 1990 and 2000 Censuses. Growth rates for six of the counties were lower than that of the State (21.1 percent), while growth rates were somewhat higher for the other six counties. The least growth occurred in Grays Harbor County, where the population increased by less than five percent between 1990 and 2000. The most population growth occurred in Snohomish and Whatcom counties, where the rate was greater than 30 percent for the same time period.

Per capita income in King County, at nearly $46,000, is the highest in the State and well above the State average that is just under $32,000. King County is also the only county of the 12 containing CHD with a per capita income greater than that of the State average. However, it should be noted that Washington State income averages are driven up strongly by King County's large population and highly paid high-tech and aerospace industries. The lowest per capita incomes among the 12 counties are in Pacific and Mason counties, at $21,533 and $21,610, respectively.

The poverty rate for a region is the percentage of people who are estimated to live below the poverty level, which is based on national levels set for minimum income requirements for various sizes of households. Poverty rates vary a great deal among the 12 counties containing CHD, ranging from a low of 7.1 percent in Snohomish County to a high of 15.0 percent in Grays Harbor County. Seven of the counties have poverty rates greater than the State average of 9.6 percent.

3.1.3 EMPLOYMENT

Employment is a key economic indicator, as patterns of growth and decline in a region's employment are largely driven by economic cycles and local economic activity. Current employment figures can be examined to provide a "snapshot" of a region's economy, highlighting key industries. Recent employment data for the 12 counties containing proposed critical habitat for the Coastal-Puget Sound population of bull trout are presented in Table 4. Employment is given for each industry group in terms of the number of jobs, which includes both full-time and part-time jobs, and as a percentage of the total jobs for each county.

Table 4
2001 Employment in Counties Containing Proposed Critical Habitat for the Coastal-Puget Sound Population of Bull Trout
(Number of Jobs and Percentage of Total Jobs)

		Clallam	Grays Harbor	Island	Jefferson	King	Mason
	Total Employment	**32,572**	**31,835**	**34,769**	**13,495**	**1,429,299**	**17,919**
Goods Producing:	Agricultural Production (Farm)	449 *(1.4%)*	587 *(1.8%)*	422 *(1.2%)*	183 *(1.4%)*	2,236 *(0.2%)*	317 *(1.8%)*
	Forestry, Hunting, Fishing, and Related Activities[a/]	1,048 *(3.2%)*	(D)	(D)	373 *(2.8%)*	4,369 *(0.3%)*	(D)
	Mining	74 *(0.2%)*	(D)	(D)	77 *(0.6%)*	1,402 *(0.1%)*	(D)
	Construction	2,293 *(7.0%)*	1,680 *(5.3%)*	2,409 *(6.9%)*	1,119 *(8.3%)*	79,128 *(5.5%)*	1,240 *(6.9%)*
	Manufacturing	1,729 *(5.3%)*	3,470 *(10.9%)*	644 *(1.9%)*	932 *(6.9%)*	143,102 *(10.0%)*	1,917 *(10.7%)*
Service Providing:	Trade, Transport, and Utilities[b/]	5,918 *(18.2%)*	(D)	4,577 *(13.2%)*	2,043 *(15.1%)*	273,603 *(19.1%)*	2,846 *(15.9%)*
	Leisure and Hospitality[c/]	3,140 *(9.6%)*	3,036 *(9.5%)*	2,702 *(7.8%)*	1,694 *(12.6%)*	126,371 *(8.8%)*	1,260 *(7.0%)*
	Financial Activities[d/]	2,675 *(8.2%)*	2,092 *(6.6%)*	3,026 *(8.7%)*	1,187 *(8.8%)*	128,351 *(9.0%)*	1,424 *(7.9%)*
	Information	491 *(1.5%)*	270 *(0.8%)*	412 *(1.2%)*	198 *(1.5%)*	77,891 *(5.4%)*	158 *(0.9%)*
	Professional and Business Services[e/]	2,611 *(8.0%)*	1,777 *(5.6%)*	3,263 *(9.4%)*	1,531 *(11.3%)*	230,109 *(16.1%)*	(D)
	Educational and Health Services[f/]	3,140 *(9.6%)*	2,559 *(8.0%)*	2,441 *(7.0%)*	1,252 *(9.3%)*	136,253 *(9.5%)*	1,328 *(7.4%)*
	Other Services	2,096 *(6.4%)*	2,188 *(6.9%)*	1,800 *(5.2%)*	815 *(6.0%)*	62,694 *(4.4%)*	1,078 *(6.0%)*
	Government	6,908 *(21.2%)*	6,474 *(20.3%)*	12,662 *(36.4%)*	2,091 *(15.5%)*	163,790 *(11.5%)*	4,580 *(25.6%)*

(D) not shown to avoid disclosure of confidential information; estimates for this item are included in the totals
a/ also includes Agricultural Services
b/ includes Utilities, Transportation and Warehousing, Retail Trade, and Wholesale Trade
c/ includes Accommodation and Food Services, and Arts, Entertainment, and Recreation
d/ includes Finance and Insurance, and Real Estate and Rental and Leasing
e/ includes Professional, Scientific, and Technical Services, Administrative Support, Waste Management, and Remediation Services, and Management of Companies and Enterprises
f/ includes Education Services and Heath Care and Social Assistance
Source: U.S. Department of Commerce, Bureau of Economic Analysis, May 2003, *Regional Economic Information System 1969-2001*, CD-ROM.

Table 4 (continued)
2001 Employment in Counties Containing Proposed Critical Habitat for the Coastal-Puget Sound Population of Bull Trout
(Number of Jobs and Percentage of Total Jobs)

		Pacific	Pierce	Skagit	Snohomish	Thurston	Whatcom
	Total Employment	**9,486**	**335,842**	**60,342**	**280,474**	**112,929**	**94,808**
Goods Producing:	Agricultural Production (Farm)	360 *(3.8%)*	2,083 *(0.6%)*	3,142 *(5.2%)*	2,153 *(0.8%)*	1,759 *(1.6%)*	3,484 *(3.7%)*
	Forestry, Hunting, Fishing, and Related Activities[a/]	912 *(9.6%)*	1,581 *(0.5%)*	1,611 *(2.7%)*	1,658 *(0.6%)*	1,111 *(1.0%)*	1,788 *(1.9%)*
	Mining	51 *(0.5%)*	368 *(0.1%)*	(D)	614 *(0.2%)*	109 *(0.1%)*	184 *(0.2%)*
	Construction	397 *(4.2%)*	22,217 *(6.6%)*	4,569 *(7.6%)*	22,340 *(8.0%)*	6,222 *(5.5%)*	7,996 *(8.4%)*
	Manufacturing	874 *(9.2%)*	21,504 *(6.4%)*	6,253 *(10.4%)*	51,099 *(18.2%)*	3,429 *(3.0%)*	8,641 *(9.1%)*
Service Providing:	Trade, Transport, and Utilities[b/]	(D)	60,411 *(18.0%)*	10,856 *(18.0%)*	47,647 *(17.0%)*	17,280 *(15.3%)*	17,346 *(18.3%)*
	Leisure and Hospitality[c/]	1,278 *(13.5%)*	28,898 *(8.6%)*	5,893 *(9.8%)*	21,578 *(7.7%)*	8,242 *(7.3%)*	9,207 *(9.7%)*
	Financial Activities[d/]	652 *(6.9%)*	27,588 *(8.2%)*	4,031 *(6.7%)*	21,439 *(7.6%)*	7,696 *(6.8%)*	6,498 *(6.9%)*
	Information	62 *(0.7%)*	4,359 *(1.3%)*	648 *(1.1%)*	4,878 *(1.7%)*	1,630 *(1.4%)*	1,996 *(2.1%)*
	Professional and Business Services[e/]	500 *(5.3%)*	28,907 *(8.6%)*	(D)	25,121 *(9.0%)*	9,773 *(8.7%)*	9,492 *(10.0%)*
	Educational and Health Services[f/]	676 *(7.1%)*	42,282 *(12.6%)*	5,625 *(9.3%)*	25,024 *(8.9%)*	13,539 *(12.0%)*	9,535 *(10.1%)*
	Other Services	598 *(6.3%)*	19,838 *(5.9%)*	3,194 *(5.3%)*	15,036 *(5.4%)*	6,374 *(5.6%)*	5,136 *(5.4%)*
	Government	1,949 *(20.5%)*	75,806 *(22.6%)*	9,896 *(16.4%)*	41,887 *(14.9%)*	35,765 *(31.7%)*	13,505 *(14.2%)*

(D) not shown to avoid disclosure of confidential information; estimates for this item are included in the totals
a/ also includes Agricultural Services
b/ includes Utilities, Transportation and Warehousing, Retail Trade, and Wholesale Trade
c/ includes Accommodation and Food Services, and Arts, Entertainment, and Recreation
d/ includes Finance and Insurance, and Real Estate and Rental and Leasing
e/ includes Professional, Scientific, and Technical Services, Administrative Support, Waste Management, and Remediation Services, and Management of Companies and Enterprises
f/ includes Education Services and Heath Care and Social Assistance
Source: U.S. Department of Commerce, Bureau of Economic Analysis, May 2003, *Regional Economic Information System 1969-2001*, CD-ROM.

Total employment in Clallam County is 32,572, which accounts for less than one percent of the State's total employment. Employment in goods producing industries is centered on forest-related production, such as lumber, plywood, and log exports.[66] Trade and services are significant employers, as demand has grown with the high number of retirees moving to the area as well as increased tourism.[67] Government is a relatively large employer, representing more than one-fifth of total employment in the county. Much of this employment is in the K-12 education system.[68]

The 31,835 jobs in Grays Harbor County account for less than one percent of the total for the State. Similar to Clallam County, more than one-fifth of the jobs in the county are in government, most of which is related to the local K-12 education system.[69] Manufacturing employment accounts for nearly 11 percent of the county's total employment, and is mostly related to lumber and wood processing.[70]

Total employment in Island County is 34,769, or less than one percent of total employment in Washington State. Government jobs, which account for over 36 percent of the county's total employment, drive the county economy as government payrolls feed into other sectors, such as trade and services. The large number of government jobs is mostly related to the presence of the Naval Air Station at Whidbey Island, and includes both military and other support personnel.[71] While the county economy is largely based on government jobs, other important aspects of the economy include a large retail sector, a fast growing service sector, and tourism.[72] Tourism is not shown in employment data as a specific industry, but rather encompasses a number of activities that are spread across several industries, such as trade and services.

Jefferson County's total employment is 13,495, which makes up just one-half percent of the State's total employment. The county economy is fairly diversified, revolving around five broadly defined industries: local government, food service, paper and allied product manufacturing, tourism and recreation, and services.[73] Well over half of Jefferson County is part of Olympic National Park and Olympic National Forest, and both serve to attract tourists and recreationists to the area.

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66 Washington Employment Security Department, Labor Market and Economic Analysis, December 2001, *Clallam County Profile*.

67 Ibid.

68 Ibid.

69 Washington Employment Security Department, Labor Market and Economic Analysis, April 2002, *Grays Harbor and Pacific Counties Profile*.

70 Ibid.

71 Washington Employment Security Department, Labor Market and Economic Analysis, April 2000, *Island County Profile.*

72 Ibid.

73 Washington Employment Security Department, Labor Market and Economic Analysis, July 2000, *Jefferson County Profile*

King County is unique among Washington counties in that it dominates the State in a number of ways – the county is home to nearly 29 percent of the State's population, as discussed earlier, and employment within the county represents over 40 percent of total employment in the State. Total employment for King County exceeds 1.4 million jobs. The county has a highly diversified economic base, with a significant orientation toward the high tech industry.[74] Employment is primarily in the service providing industries, such as trade, transportation, and professional and business services.

Mason County employment totals 17,919, or about one-half percent of Washington State's total employment. Traditional resource-based industries in the county, such as logging, farming, and oyster cultivation, have been replaced by more service-oriented jobs.[75] Logging and lumber remain a part of the manufacturing industry, which makes up about 11 percent of jobs in the county. Government is the largest employer, with over one-quarter of the jobs in the county, most of which are related to local K-12 education and a State correctional facility.

With the smallest population of the 12 counties containing CHD, it is not surprising that Pacific County also has the fewest number of jobs. Total employment is 9,486, which is only one-quarter percent of total employment in the State of Washington. Over 13 percent of these jobs are in agriculture, forestry, fishing, and related industries, and much of this employment is in fishing, primarily for shellfish.[76] Like many of the smaller counties in Washington, government is the largest employer, accounting for over 20 percent of county jobs, most related to local K-12 education.

Total employment in Pierce County is 335,842, or about 10 percent of the State's total employment. A number of strong and expanding industries, well-developed infrastructure, and prime location with access to all modes of transportation all contribute to a vibrant and diverse county economy.[77] About 23 percent of county jobs are in government, and many of these are Federal civilian jobs or military related to the major military facilities, McChord Air Force Base and Fort Lewis, located in Pierce County. There is also a strong educational presence due to a number of college and universities located in the county.

Skagit County, with 60,342 total jobs, makes up nearly two percent of Washington State's total employment. Unlike most other counties in western Washington, agriculture is a significant industry in Skagit County. Over five percent of jobs in the county are in agricultural production, many of these

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74 Washington Employment Security Department, Labor Market and Economic Analysis, March 2001, *King County Profile.*

75 Washington Employment Security Department, Labor Market and Economic Analysis, March 2002, *Mason County Profile.*

76 Washington Employment Security Department, Labor Market and Economic Analysis, April 2002, *Grays Harbor and Pacific Counties Profile*.

77 Washington Employment Security Department, Labor Market and Economic Analysis, March 2001, *Pierce County Profile.*

related to bulb production (tulips), vegetable farming, and dairies.[78] The county economy is fairly diverse, not relying a great deal on any single industry.

Snohomish County is another of the larger counties among the 12 containing CHD, with total employment of 280,474, or about eight percent of total employment for the State. The large local presence of Boeing, an aircraft manufacturer, is seen in the number of jobs within the manufacturing industry, which accounts for over 18 percent of the county's total employment. The county reflects a mixture of rural and urban economies as the northern and eastern part of the county is dominated by agriculture and logging while high tech employment dominates the southern part of the county.[79]

Total employment in Thurston County is 112,929, or three percent of employment in the State of Washington. Government is the dominant employer in the county, accounting for nearly one-third of all jobs in the county. The strong presence of government is largely related to the State capital, Olympia, being located within the county. Retail trade and health and business services are also significant employers in Thurston County.[80]

With total employment of 94,808, Whatcom County contributes about three percent of the jobs in Washington State. The economy is fairly diverse, with no one industry responsible for a significantly large share of employment. Government has a fairly strong presence, with about 14 percent of jobs in the county, and some of the larger government employers include Western Washington University and the U.S. Customs Service.[81] The trade, transportation, and utilities industry group is responsible for about 18 percent of county employment, much related to retail trade.

Earnings represent the sum of three components of personal income: wage and salary disbursements, other labor income (includes employer contribution to pension and profit-sharing, health and life insurance, and other non-cash compensation), and proprietors' income. Earnings reflect the amount of income that is derived directly from work and work-related factors. Earnings can be used as a proxy for the income that is generated within a geographical area by industry sectors, and can be used to identify the significant income-producing industries of a region or to show trends in industry growth or decline. Earnings from employment in counties containing proposed CHD are presented in Table 5, broken out by industry group as employment was in the previous table.

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78 Washington Employment Security Department, Labor Market and Economic Analysis, January 2002, *Skagit County Profile.*

79 Washington Employment Security Department, Labor Market and Economic Analysis, April 2001, *Snohomish County Profile.*

80 Washington Employment Security Department, Labor Market and Economic Analysis, December 1999, *Thurston County Profile.*

81 Washington Employment Security Department, Labor Market and Economic Analysis, March 2001, *Whatcom County Profile.*

Table 5
2001 Earnings from Employment in Counties Containing Proposed Critical Habitat for the Coastal-Puget Sound Population of Bull Trout (Millions of Dollars and Percentage of Total Earnings)

		Clallam	Grays Harbor	Island	Jefferson	King	Mason
	Total Employment	**$782.9**	**$879.7**	**$1,037.0**	**$296.8**	**$71,195.3**	**$452.3**
Goods Producing:	Agricultural Production (Farm)	$1.9 *(0.2%)*	$7.9 *(0.9%)*	$3.3 *(0.3%)*	$1.8 *(0.6%)*	$34.4 *(0.0%)*	(D)
	Forestry, Hunting, Fishing, and Related Activities[a/]	$37.3 *(4.8%)*	(D)	(D)	$5.5 *(1.9%)*	$342.8 *(0.5%)*	(D)
	Mining	$0.9 *(0.1%)*	(D)	(D)	$1.3 *(0.4%)*	$38.7 *(0.1%)*	(D)
	Construction	$72.0 *(9.2%)*	$54.2 *(6.2%)*	$72.2 *(7.0%)*	$31.4 *(10.6%)*	$4,262.0 *(6.0%)*	$37.9 *(8.4%)*
	Manufacturing	$45.6 *(5.8%)*	$147.6 *(16.8%)*	$24.2 *(2.3%)*	$35.8 *(12.0%)*	$8,509.8 *(12.0%)*	$64.4 *(14.2%)*
Service Providing:	Trade, Transport, and Utilities[b/]	$121.7 *(15.5%)*	(D)	$86.3 *(8.3%)*	$42.1 *(14.2%)*	$11,349.0 *(15.9%)*	$59.4 *(13.1%)*
	Leisure and Hospitality[c/]	$38.2 *(4.9%)*	$47.6 *(5.4%)*	$34.0 *(3.3%)*	$19.7 *(6.6%)*	$2,927.7 *(4.1%)*	$17.4 *(3.8%)*
	Financial Activities[d/]	$31.4 *(4.0%)*	$33.7 *(3.8%)*	$36.1 *(3.5%)*	$15.5 *(5.2%)*	$5,502.7 *(7.7%)*	$16.2 *(3.6%)*
	Information	$12.6 *(1.6%)*	$6.5 *(0.7%)*	$12.0 *(1.2%)*	$4.7 *(1.6%)*	$12,039.6 *(16.9%)*	$3.9 *(0.9%)*
	Professional and Business Services[e/]	$50.1 *(6.4%)*	$45.5 *(5.2%)*	$68.7 *(6.6%)*	$26.2 *(8.8%)*	$11,948.0 *(16.8%)*	(D)
	Educational and Health Services[f/]	$76.1 *(9.7%)*	$75.1 *(8.5%)*	$46.4 *(4.5%)*	$23.5 *(7.9%)*	$5,003.3 *(7.0%)*	$32.5 *(7.2%)*
	Other Services	$32.3 *(4.1%)*	$32.4 *(3.7%)*	$27.1 *(2.6%)*	$13.2 *(4.4%)*	$1,600.7 *(2.2%)*	$18.5 *(4.1%)*
	Government	$262.8 *(33.6%)*	$230.8 *(26.2%)*	$621.7 *(60.0%)*	$76.0 *(25.6%)*	$7,636.6 *(10.7%)*	$162.0 *(35.8%)*

(D) not shown to avoid disclosure of confidential information; estimates for this item are included in the totals
1/ also includes Agricultural Services
2/ includes Utilities, Transportation and Warehousing, Retail Trade, and Wholesale Trade
3/ includes Accommodation and Food Services, and Arts, Entertainment, and Recreation
4/ includes Finance and Insurance, and Real Estate and Rental and Leasing
5/ includes Professional, Scientific, and Technical Services, Administrative Support, Waste Management, and Remediation Services, and Management of Companies and Enterprises
6/ includes Education Services and Heath Care and Social Assistance
Source: U.S. Department of Commerce, Bureau of Economic Analysis, May 2003, *Regional Economic Information System 1969-2001*, CD-ROM.

Table 5 (continued)
2001 Earnings from Employment in Counties Containing Proposed Critical Habitat for the Coastal-Puget Sound Population of Bull Trout
(Millions of Dollars and Percentage of Total Earnings)

		Pacific	Pierce	Skagit	Snohomish	Thurston	Whatcom
	Total Employment	**$197.4**	**$11,383.3**	**$1,764.4**	**$10,179.3**	**$3,683.3**	**$2,664.7**
Goods Producing:	Agricultural Production (Farm)	$10.6 *(5.4%)*	$23.6 *(0.2%)*	$84.0 *(4.8%)*	$20.0 *(0.2%)*	$25.0 *(0.7%)*	$72.3 *(2.7%)*
	Forestry, Hunting, Fishing, and Related Activities[a/]	$17.1 *(8.6%)*	$41.8 *(0.4%)*	$48.8 *(2.8%)*	$46.4 *(0.5%)*	$31.5 *(0.9%)*	$33.3 *(1.2%)*
	Mining	$1.3 *(0.7%)*	$15.1 *(0.1%)*	(D)	$30.7 *(0.3%)*	$2.7 *(0.1%)*	$4.8 *(0.2%)*
	Construction	$7.4 *(3.8%)*	$887.8 *(7.8%)*	$187.5 *(10.6%)*	$914.4 *(9.0%)*	$226.9 *(6.2%)*	$318.6 *(12.0%)*
	Manufacturing	$21.2 *(10.8%)*	$1,011.4 *(8.9%)*	$242.6 *(13.8%)*	$3,157.2 *(31.0%)*	$130.1 *(3.5%)*	$383.4 *(14.4%)*
Service Providing:	Trade, Transport, and Utilities[b/]	(D)	$1,791.2 *(15.7%)*	$280.9 *(15.9%)*	$1,304.6 *(12.8%)*	$473.4 *(12.9%)*	$436.0 *(16.4%)*
	Leisure and Hospitality[c/]	$14.9 *(7.6%)*	$420.7 *(3.7%)*	$101.1 *(5.7%)*	$325.5 *(3.2%)*	$127.6 *(3.5%)*	$121.1 *(4.5%)*
	Financial Activities[d/]	$7.3 *(3.7%)*	$786.4 *(6.9%)*	$86.2 *(4.9%)*	$561.3 *(5.5%)*	$179.1 *(4.9%)*	$123.3 *(4.6%)*
	Information	$1.2 *(0.6%)*	$160.8 *(1.4%)*	$20.4 *(1.2%)*	$203.3 *(2.0%)*	$82.7 *(2.2%)*	$65.9 *(2.5%)*
	Professional and Business Services[e/]	$8.5 *(4.3%)*	$894.4 *(7.9%)*	(D)	$718.2 *(7.1%)*	$260.1 *(7.1%)*	$248.0 *(9.3%)*
	Educational and Health Services[f/]	(D)	$1,530.9 *(13.4%)*	$161.3 *(9.1%)*	$812.3 *(8.0%)*	$436.7 *(11.9%)*	$274.1 *(10.3%)*
	Other Services	$8.5 *(4.3%)*	$386.6 *(3.4%)*	$66.4 *(3.8%)*	$299.0 *(2.9%)*	$131.3 *(3.6%)*	$97.0 *(3.6%)*
	Government	$69.0 *(35.0%)*	$3,432.7 *(30.2%)*	$351.0 *(19.9%)*	$1,786.5 *(17.5%)*	$1,576.2 *(42.8%)*	$486.9 *(18.3%)*

(D) not shown to avoid disclosure of confidential information; estimates for this item are included in the totals
a/ also includes Agricultural Services
b/ includes Utilities, Transportation and Warehousing, Retail Trade, and Wholesale Trade
c/ includes Accommodation and Food Services, and Arts, Entertainment, and Recreation
d/ includes Finance and Insurance, and Real Estate and Rental and Leasing
e/ includes Professional, Scientific, and Technical Services, Administrative Support, Waste Management, and Remediation Services, and Management of Companies and Enterprises
f/ includes Education Services and Heath Care and Social Assistance
Source: U.S. Department of Commerce, Bureau of Economic Analysis, May 2003, *Regional Economic Information System 1969-2001*, CD-ROM.

3.1.4 TRIBES IN THE COASTAL-PUGET SOUND REGION

Proposed critical habitat for the Coastal-Puget Sound population of bull trout includes streams, lakes, and marine shoreline areas that are within or adjacent to a number of Indian reservations. These include the Lummi, Swinomish, Sauk-Suiattle, Tulalip, Muckleshoot, Puyallup, Nisqually, Skokomish, Lower Elwha S'Klallam, Hoh, Quinault, Nooksack, and Chehalis Indian Reservations, and Jamestown S'Klallam tribal lands.[82] Tribal lands make up approximately five percent of land adjacent to the proposed critical habitat.

The Service is proposing to exclude lands on the Quinault Indian Reservation from the CHD that are covered by the recently developed Quinault Forest Management Plan (FMP). The Service has met with the Northwest Indian Fisheries Commission (NWIFC) and some of the tribes they represent. The Service plans to continue to meet with the other tribes in the Coastal-Puget Sound region regarding the bull trout critical habitat process, as well as existing or planned tribal conservation activities for bull trout. Through these consultations with tribes included in the proposed designation of critical habitat, the Service will determine the appropriateness of excluding other tribal areas from the final designation based on the conservation activities provided for the bull trout.[83] Just prior to the release of this draft economic analysis, the Service determined that the area of the Hoh Indian Reservation would be excluded from the final designation.

Land and population characteristics of those tribes potentially affected by the proposed CHD for bull trout are presented in Table 6. The land base for each tribe consists mostly of reservation lands, but in some cases also includes some off-reservation trust lands.[84] Tribal enrollment numbers as reported by each tribe in 1998 are presented, which includes tribal members that may or may not live on reservation or trust lands. Population data from the 2000 Census are shown for the total (all races) population of tribal reservation and off-reservation trust lands, as well as those who identified themselves as American Indian or Alaska Native (AIAN), whether they indicated this race alone or in combination with one or more other race.

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82 Specific details on critical habitat areas within or adjacent to tribal lands are available in the critical habitat designation proposed rule (U.S. Fish and Wildlife Service, June 25, 2004, "Proposed Designation of Critical Habitat for the Jarbidge River, Coastal-Puget Sound, and Saint Mary-Belly River Populations of Bull Trout, Proposed Rule," *Federal Register*, Vol. 69, No. 122, pp. 35768-35857).

83 U.S. Fish and Wildlife Service, June 25, 2004 "Proposed Designation of Critical Habitat for the Jarbidge River, Coastal-Puget Sound, and Saint Mary-Belly River Populations of Bull Trout, Proposed Rule," *Federal Register*, Vol. 69, No. 122, pp. 35768-35857.

84 Off-reservation trust lands are lands owned by the United States and held in trust on behalf of the tribe.

Table 6
Reservation Land and Population Characteristics of Indian Tribes with Lands Adjacent to or Encompassing Proposed CHD for Bull Trout

Tribe	Land Area (square miles)	Enrolled Membership 1997-98[a/]	Population on Reservation and Off-Reservation Trust Lands	
			Total (All Races)	American Indian and Alaska Native[b/]
Chehalis Confederated Tribes	7.02	525	691	424
Hoh Tribe	0.74	147	102	86
Jamestown S'Klallam Tribe	0.06	230	16	3
Lower Elwha S'Klallam Tribe	0.77	750	315	274
Lummi Nation	21.00	3,519	4,193	2,240
Muckleshoot Tribe	6.13	1,170	3,606	1,095
Nisqually Tribe	7.95	500	588	392
Nooksack Tribe	4.25	1,341	547	436
Puyallup Tribe	28.55	2,219	41,341	1,940
Quinault Nation	316.33	2,217	1,370	1,069
Sauk-Suiattle Tribe	0.07	237	45	37
Skokomish Tribe	8.20	820	730	519
Swinomish Tribe	12.12	753	2,664	655
The Tulalip Tribes	35.26	2,934	9,246	2,265

a/ Tribal enrollment figures are based on 1997-98 data from individual Indian tribes and the Indian Health Service, except for the Hoh Tribe, in which case the figure shown is 1995 data from the Bureau of Indian Affairs. Tribal enrollment figures include all tribal members irrespective of residence – many tribal enrolled members live off of reservations or trust lands.

b/ Includes residents of reservation or off-reservation trust lands who selected American Indian and Alaska Native (AIAN) as race, whether they selected AIAN alone or in combination with one or more other races.

Sources: Tiller, Veronica E., and Robert A. Chase, 1998, *Economic Contributions of Indian Tribes to the Economy of Washington State* (tribal membership enrollment); U.S. Census Bureau, Census 2000 Summary File 1, custom table retrieved from http://factfinder.census.gov (total area, total and American Indian and Alaska Native population on reservation and off-reservation trust lands).

Table 7 presents socioeconomic characteristics for the residents of tribal lands potentially affected by the proposed CHD, including unemployment and poverty rates and per capita income.[85] Similar data for the county in which each reservation is primarily located are also presented for comparison, as well as data

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85 Data for Indian reservations and off-reservation trust lands presented in Table 7 are based on all residents living within the boundaries of the Indian reservation or off-reservation trust lands. Therefore, all races are represented, not just the Indian population.

for the State of Washington. In this table, unemployment rate is the percentage of civilians 16 years old or older who reported that they were unemployed members of the labor force in the 2000 Census. The poverty rate is also based on 2000 Census data and represents the percentage of individuals who reported 1999 income less than a nationally-determined poverty level. Per capita income in this table is based on 1999 income reported in the 2000 Census. These data differ from those presented earlier in the socioeconomic profile for the counties in the Coastal-Puget Sound region as it was necessary to use alternative sources and years of data to obtain tribal information.

3.1.4.1 Reservation Descriptions and Socioeconomic Characteristics

The Chehalis Indian Reservation encompasses approximately seven square miles of land and is located in the southeastern corner of Grays Harbor County bordering Thurston County, southeast of Oakville, Washington. The proposed CHD includes a portion of the Chehalis River within or adjacent to the Chehalis Indian Reservation. Tribal enrollment for the Chehalis Confederated Tribes was 525 in 1998, and 424 of the 691 residents of the reservation identified themselves as AIAN for the 2000 Census. Reservation residents reported a 12.4 percent unemployment rate in 2000, compared to 8.3 percent for Grays Harbor County and 6.2 percent for Washington State. Per capita income for reservation residents was $9,097 in 1999, considerably lower than that of Grays Harbor County ($16,799) and Washington State ($22,973). The poverty rate for the Chehalis Reservation was 24.4 percent in 1999, compared to 16.1 percent in Grays Harbor County and 10.6 percent for Washington State.

The Hoh Indian Reservation is located on the coast of the Pacific Ocean at the mouth of the Hoh River, and has a land area of less than one square mile. The reservation is located within Jefferson County. The proposed CHD includes portions of the Hoh River and Pacific Coast nearshore within or adjacent to the Hoh Indian Reservation; however, the Service recently proposed to exclude the Hoh Reservation from critical habitat.[86] The most recent tribal enrollment figure is from 1995, when 147 members were reported. In 2000, 86 of the 102 reservation residents identified their race as AIAN for the Census. Over one-third, or 34 percent, of reservation residents reported that they were unemployed in 2000, compared to just 6.7 percent reported for Jefferson County. Per capita income for Hoh Reservation residents was $10,008 in 1999, less than half that reported for Jefferson County ($22,211). The poverty rate for individuals living within reservation boundaries was significantly higher than that of surrounding areas, as the reservation rate was 42.0 percent, compared to 11.3 percent reported for the county.

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86 Personal communication with Service Biologist, Western Washington Field Office, January 31, 2005.

Table 7
Socioeconomic Characteristics of Tribal Lands Potentially Affected by the Proposed CHD for Bull Trout with County/State Data for Comparison

Area/Tribal Lands	Unemployment Rate (2000)	Per Capita Income (1999)	Poverty Rate (1999)
WASHINGTON STATE	**6.2%**	**$22,973**	**10.6%**
Clallam County	**7.7%**	**$19,517**	**12.5%**
Jamestown S'Klallam Res. and Off-Res. Trust Land	0.0%	$28,238	0.0%
Lower Elwha Reservation and Off-Res. Trust Land	14.6%	$8,769	26.6%
Grays Harbor County	**8.3%**	**$16,799**	**16.1%**
Chehalis Reservation[a/]	12.4%	$9,097	24.4%
Quinault Reservation[b/]	14.7%	$9,621	31.5%
Jefferson County	**6.7%**	**$22,211**	**11.3%**
Hoh Reservation	34.0%	$10,008	42.0%
King County	**4.5%**	**$29,521**	**8.4%**
Muckleshoot Reservation and Off-Res. Trust Land[c/]	8.6%	$16,890	16.0%
Mason County	**8.3%**	**$18,056**	**12.2%**
Skokomish Reservation	23.3%	$10,475	27.6%
Pierce County	**6.5%**	**$20,948**	**10.5%**
Nisqually Reservation	11.6%	$14,094	18.2%
Puyallup Reservation and Off-Res. Trust Land[d/]	5.8%	$22,263	12.2%
Skagit County	**6.9%**	**$21,256**	**11.1%**
Sauk-Suiattle Reservation[e/]	38.5%	$10,028	3.6%
Swinomish Reservation	8.4%	$25,318	13.0%
Snohomish County	**5.0%**	**$23,417**	**6.9%**
Tulalip Reservation	7.5%	$19,858	10.1%
Whatcom County	**7.4%**	**$20,025**	**14.2%**
Lummi Reservation	11.9%	$17,669	18.3%
Nooksack Reservation and Off-Res. Trust Land	12.8%	$10,515	28.5%

a/ A small portion of the Chehalis Reservation is located within Thurston County.

b/ A small portion of the Quinault Reservation is located within Jefferson County.

c/ A small portion of the Muckleshoot Reservation and Off-Reservation Trust Land is located within Pierce County.

d/ A small portion of the Puyallup Reservation and Off-Reservation Trust Land is located within King County.

e/ A small portion of the Sauk-Suiattle Reservation is located within Snohomish County.

Note: Per capita income and poverty data for counties presented here differs from data presented in Table 3 due to the use of different sources and years of data. The source and year of data shown here were chosen in order to obtain statistics for Indian reservations (not available from the sources used in Table 3) and allow comparison to similar data for the county and state.

Source: U.S. Census Bureau, Census 2000, Table DP-3: Profile of Selected Economic Characteristics – 2000, retrieved for each area from http://censtats.census.gov/pub/Profiles.shtml.

The Jamestown S'Klallam Tribe has both reservation and off-reservation trust lands totaling less than one-tenth of a square mile. The reservation is located in Clallam County on the northern Olympic Peninsula of Washington State along the southern shores of the Strait of Juan de Fuca. While the tribe reported a 1998 membership of 230, the population of the reservation and off-reservation trust lands was just 16 in 2000, of which only three persons were AIAN. Census data for the reservation and off-reservation trust lands indicates that the unemployment and poverty rates were both zero, and the per capita income was $28,238. Proposed critical habitat for the Coastal-Puget Sound population of bull trout includes portions of the Dungeness River within or adjacent to Jamestown S'Klallam tribal land.

The Lower Elwha Indian Reservation and off-reservation trust lands totals less than one square mile. The reservation is located in Clallam County on the southern shore of the Strait of Juan de Fuca at the mouth of the Elwha River, directly across from Victoria, British Columbia, and west of Port Angeles, Washington. Tribal membership in 1998 was reported as 750. The reservation and trust lands had a total population of 315 in 2000, and 274 of these residents identified their race as AIAN. The unemployment rate was 14.6 percent, nearly double the 7.7 percent unemployment rate for Clallam County. Per capita income for residents of the Lower Elwha Reservation and off-reservation trust lands was $8,769 and the poverty rate was 26.6 percent. Clallam County reported a per capita income of $19,517 and poverty rate of 12.5 percent in the 2000 Census. The proposed critical habitat for bull trout includes portions of the Elwha River and the Strait of Juan de Fuca nearshore within or adjacent to the Lower Elwha tribal lands.

The Lummi Indian Reservation is located in Whatcom County and encompasses 21 square miles of land area. The reservation is a five-mile long peninsula which forms Lummi Bay on the west, Bellingham Bay on the east, with a smaller peninsula of Sandy Point, Portage Island, and the associated tidelands.[87] Tribal membership reported in 1998 was 3,519; the 2000 Census reported a total reservation population of 4,193, with 2,240 identifying themselves as AIAN. The unemployment rate for the reservation was 11.9 percent in 2000, compared to 7.4 percent in Whatcom County. 1999 per capita income for the reservation was $17,669 and the poverty rate was 18.3 percent. Whatcom County's 1999 per capita income was $20,025 and the poverty rate was 14.2 percent. The proposed critical habitat designation includes portions of the Nooksack River and Puget Sound nearshore adjacent to the Lummi Indian Reservation.

The Muckleshoot Indian Reservation and off-reservation trust lands total just over six square miles. The reservation and off-reservation trust lands are located primarily in southern King County, south of Seattle and east of Tacoma, with a small portion within Pierce County. The tribe reported 1,170 members in 1998, and reservation and trust lands had a total population of 3,606 in 2000, with 1,095 of these residents reporting their race as AIAN. The unemployment rate for residents of the reservation and off-

87 U.S. Department of Health and Human Services, Indian Health Service, Portland Area Office, "Lummi Tribe of Indians," http://www.ihs.gov/FacilitiesServices/AreaOffices/Portland/portland-tribe-lummi.asp, accessed June 14, 2004.

reservation trust lands was 8.6 percent, while that of King County was 4.5 percent. Per capita income for reservation and trust land residents was $16,890, a little over half the per capita income of King County ($29,521). The poverty rate for tribal lands is about twice that of the county, or 16.0 percent compared to 8.4 percent. The proposed bull trout critical habitat includes portions of the White River within or adjacent to the Muckleshoot Indian Reservation.

The Nisqually Indian Reservation is located on the lower Nisqually River east of Olympia and adjacent to the Fort Lewis Military Reservation. The land area of the reservation is just under eight square miles, and located within Pierce County. In 1998, the tribal enrollment included approximately 500 members. The 2000 Census reported a total reservation population of 588, with 392 AIAN. Reservation unemployment was 11.6 percent in 2000, and the 1999 per capita income was $14,094. During the same time, Pierce County had an unemployment rate of 6.5 percent and per capita income of $20,948. The poverty rate for the reservation was 18.2 percent, while the county had a poverty rate of 10.5 percent. Portions of the Nisqually River within or adjacent to the Nisqually Indian Reservation are included in the proposed critical habitat for bull trout.

The Nooksack Indian Reservation and off-reservation trust lands total 4.25 square miles. The reservation is located east of Bellingham, Washington, in Whatcom County. Tribal membership in 1998 was reported to be 1,341. The total population of reservation and trust lands was 547 according to the 2000 Census, and 436 of these residents identified themselves as AIAN. Residents of the Nooksack Reservation and off-reservation trust lands experienced a 12.8 percent unemployment rate in 2000, compared to 7.4 percent for Whatcom County. Reservation and trust land residents reported a 1999 per capita income of $10,515, about half that reported for the county ($20,025). The poverty rate for the reservation and off-reservation trust lands was 28.5 percent, over twice Whatcom County's poverty rate of 14.2 percent. Proposed critical habitat for the Coastal-Puget Sound population of bull trout includes a portion of the Nooksack River adjacent to the Nooksack Indian Reservation.

The Puyallup Indian Reservation and off-reservation trust lands totals 28.55 square miles, and the reservation is located on Puget Sound along the lower reaches of the Puyallup River, primarily in Pierce County. A small portion of the lands are also located within King County. Tribal membership in 1998 was 2,219, and reservation and trust lands had a total population of 41,341 in 2000, with just 1,940 residents identifying themselves as AIAN. The unemployment rate for Puyallup Reservation and off-reservation trust land residents was 5.8 percent, and lower than the 6.5 percent unemployment reported for Pierce County. Per capita income for reservation and off-reservation trust land residents was greater than that for the county, or $22,263 compared to $20,948. Reservation and off-reservation residents, however, displayed a slightly higher poverty rate, reported at 12.2 percent compared to 10.5 percent for Pierce County. Critical habitat proposed for the Coastal-Puget Sound population of bull trout includes portions of the Puyallup River and Puget Sound nearshore within or adjacent to the Puyallup Indian Reservation.

The Quinault Indian Reservation has a land area of over 316 miles, the largest of the reservations potentially affected by the proposed CHD for the Coastal-Puget Sound population of bull trout. The reservation is located on the Pacific Coast below Lake Quinault on both sides of the Quinault River, within both Grays Harbor and Jefferson counties. Tribal enrollment was reported as 2,217 in 1998. The total reservation population in 2000 was 1,370, with 1,069 of these residents identifying their race as AIAN. Reservation unemployment was 14.7 percent in 2000, compared to Grays Harbor unemployment rate of 8.3 percent. Per capita income for reservation residents was $9,621, while that of the county was $16,799. While Grays Harbor County had a poverty rate of 16.1 percent, the reservation poverty rate was nearly double, at 31.5 percent. The proposed CHD includes portions or all of the Quinault River, Lake Quinault, Pacific Coast nearshore, Raft River, Queets River, Salmon River, Moclips River, Cook Creek, and Elk Creek within or adjacent to the Quinault Indian Reservation.[88]

The Sauk-Suiattle Indian Reservation has a land area of less than one-tenth of a square mile, and is located on the western side of the Sauk River south of the confluence of the Sauk and Suiattle rivers. The reservation includes lands in both Skagit and Snohomish counties. There were 237 enrolled members of the Sauk-Suiattle Tribe in 1998. The total population of the reservation was 45 in 2000, with 37 of these people identifying themselves as AIAN. The reservation unemployment rate was 38.5 percent in 2000, compared to 6.9 and 5.0 percent in Skagit and Snohomish counties, respectively. Per capita income for the reservation was $10,028, or less than half the $21,256 per capita income of Skagit County. The reservation poverty rate of 3.6 percent is surprisingly low, but may be due to the small sample size for which poverty status was measured. Skagit County had a poverty rate of 11.1 percent. The proposed bull trout critical habitat includes a portion of the Sauk River adjacent to the Sauk-Suiattle Indian Reservation.

The Skokomish Indian Reservation is located in northern Mason County on the Olympic Peninsula and encompasses 8.2 square miles of land area. The Skokomish River and Hood Canal form the southern and eastern boundaries of the reservation. In 1998, there were 820 enrolled members of the Skokomish Tribe. The reservation had a total population of 730 in 2000, with 519 of these residents identifying their race as AIAN. Reservation unemployment was 23.3 percent in 2000, nearly three times that of Mason County, which was 8.3 percent. The reservation also reported a greater poverty rate than that of the county, with 27.6 percent of the reservation population living below the poverty level in 1999 compared to 12.2 percent of Mason County. Per capita income for the reservation was $10,475 in 1999, while that of the county was $18,056. Portions of the Skokomish River, Nalley Slough, Skobob Creek, and Hood Canal nearshore within or adjacent to the Skokomish Indian Reservation are included in the proposed CHD for the bull trout.

The Swinomish Indian Reservation has a land area of approximately 12 square miles, and is located on a small peninsula in upper Puget Sound within Skagit County. The Swinomish Slough, a narrow water channel, forms the eastern boundary of the reservation. The Swinomish Tribe reported a 1998 enrollment of 753 members. The total population of the reservation was 2,664 in 2000, of which 655 people identified their race as AIAN. Economic conditions for residents of the reservation are similar to those of Skagit County. Reservation unemployment at 8.4 percent is only slightly higher than the 6.9 percent rate

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88 As discussed elsewhere in this report, the Service has proposed to exclude from the CHD those areas of the Quinault Indian Reservation that are covered by the Quinault Forest Management Plan.

for the county. Reservation per capita income, at $25,318, is greater than that of the county, at $21,256. While 13.0 percent of the reservation population reported income below the poverty level in 1999, the county had a slightly lower poverty rate of 11.1 percent. Proposed critical habitat for the Coastal-Puget Sound population of the bull trout includes the Swinomish Channel and portions of the Puget Sound nearshore within or adjacent to the Swinomish Indian Reservation.

The Tulalip Indian Reservation has a land area of 35.26 square miles and is located west of Interstate 5 in Snohomish County, bordered on the south by the Snohomish River and on the west by Puget Sound. Tribal membership was 2,934 in 1998, and the reservation had a total population of 9,246 in 2000, of which 2,265 identified their race as AIAN. The unemployment rate for the reservation was 7.5 percent in 2000, compared to 5.0 percent for Snohomish County. Per capita income for the reservation was $19,858, lower than the $23,417 per capita income reported for the county. The reservation poverty rate was 10.1 percent in 1999, compared to 6.9 percent for the county. The proposed CHD includes portions of the Snohomish River and Puget Sound nearshore within or adjacent to the Tulalip Indian Reservation.

3.2 REGULATORY ENVIRONMENT

3.2.1 OTHER SPECIES LISTED UNDER THE ACT

It is important to consider other species in the Coastal-Puget Sound region listed under the Act, as listing or critical habitat-related protections for other threatened and endangered species may also benefit bull trout. When a consultation is triggered for any listed species, the Service will also take into account all other listed species known or thought to occupy areas on or near the project lands. Past Section 7 consultations for the bull trout have included a number of listed species including the northern spotted owl (*Strix occidentalis caurina*), marbled murrelet (*Brachyrampus marmoratus*), and the Puget Sound ESU of Chinook salmon (*Oncorhynchus tshawytscha*).

For the streams, lakes, and marine shorelines that are part of the proposed critical habitat for bull trout in the Coastal-Puget Sound population, there are some protections already in place for listed anadromous salmon. Other listed species found in the region and which have protection and conservation activities in place that might also benefit bull trout are the northern spotted owl and marbled murrelet.

Salmon species that have been listed as threatened for two of the Evolutionary Significant Units (ESUs)[89] that overlap the proposed CHD for the Coastal-Puget Sound population of bull trout include the Hood Canal Summer-Run Chum Salmon ESU and the Puget Sound Chinook Salmon ESU. The overlapping Puget Sound/Strait of Georgia Coho Salmon ESU was previously designated as a "candidate" for listing, but is now designated a "species of concern." "Species of concern" is a term used to identify species about which NMFS has some concerns regarding status or threats, but for which insufficient information

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[89] An Evolutionarily Significant Unit or "ESU" is a distinctive group of Pacific salmon, steelhead, or sea-run cutthroat trout.

is available to indicate a need to list the species under the Act.[90] Table 8 shows the listing history and current status of these salmon species. Map 8 in the Map Attachment to this report shows the geographic overlap of the proposed bull trout CHD with the two threatened salmon ESUs: Hood Canal Summer-Run Chum and Puget Sound Chinook.

Table 8
Listing Status of Threatened and Candidate Salmon Species Overlapping with Coastal-Puget Sound Population of Bull Trout

ESU	Status	Listing History
Hood Canal Summer-Run Chum Salmon ESU	Threatened	Proposed listing as threatened March 10, 1998[91] Final rule listing as threatened March 25, 1999[92] Proposed CHD December 14, 2004[93]
Puget Sound Chinook Salmon ESU	Threatened	Proposed listing as threatened March 9, 1998[94] Final rule listing as threatened March 24, 1999[95] Proposed CHD December 14, 2004[96]
Puget Sound/Strait of Georgia Coho Salmon ESU	Species of Concern	Added to candidate species list July 25, 1995[97] Transferred to species of concern list April 15, 2004[98] CHD not applicable

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90 U.S. Department of Commerce, NOAA, April 15, 2004, "Establishment of Species of Concern List, Addition of Species to Species of Concern List, Description of Factors for Identifying Species of Concern, and Revision of Candidate Species List Under the Endangered Species Act," *Federal Register,* Vol. 69, No. 73, p. 19976.

91 U.S. Department of Commerce, NOAA, March 10, 1998, "Proposed Threatened Status and Designated Critical Habitat for Hood Canal Summer-Run Chum and Salmon Columbia River Chum Salmon, Proposed Rule," *Federal Register,* Vol. 63, No. 46, pp. 11774-11795.

92 U.S. Department of Commerce, NOAA, March 25, 1999, "Threatened Status for Two ESUs of Chum Salmon in Washington and Oregon, Final Rule," *Federal Register,* Vol. 64, No. 57, pp. 14508-14717.

93 U.S. Department of Commerce, NOAA, December 14, 2004, "Designation of Critical Habitat for 13 Evolutionarily Significant Units of Pacific Salmon (*Oncorhynchus* spp.) and Steelhead (*O. mykiss*) in Washington, Oregon, and Idaho; Proposed Rule," *Federal Register*, Vol. 69, No. 239, pp. 74572-74846.

94 U.S. Department of Commerce, NOAA, March 9, 1998, "Proposed Endangered Status for Two Chinook Salmon ESUs and Proposed Threatened Status for Five Chinook Salmon ESUs; Proposed Redefinition, Threatened Status, and Revision of Critical Habitat for One Chinook Salmon ESU; Proposed Designation of Chinook Salmon Critical Habitat in California, Oregon, Washington, Idaho, Proposed Rule," *Federal Register,* Vol. 63, No. 45, pp. 11482-11520.

95 U.S. Department of Commerce, NOAA, March 24, 1999, "Threatened Status for Three Chinook Salmon Evolutionarily Significant Units (ESUs) in Washington and Oregon, and Endangered Status for One Chinook Salmon ESU in Washington, Final Rule," *Federal Register*, Vol. 64, No. 56, pp. 14308-14328.

96 U.S. Department of Commerce, NOAA, December 14, 2004, "Designation of Critical Habitat for 13 Evolutionarily Significant Units of Pacific Salmon (*Oncorhynchus* spp.) and Steelhead (*O. mykiss*) in Washington, Oregon, and Idaho; Proposed Rule," *Federal Register*, Vol. 69, No. 239, pp. 74572-74846.

3.2.1.1 Implications for Estimating Costs Attributable to the Bull Trout

In the Coastal-Puget Sound region, 53 of the 83 HUCs, or 64 percent, contain stream reaches with proposed critical habitat for bull trout that overlap with the ESUs for the previously listed salmonids.[99] In the analyses presented in this section, the procedure outlined in Section 2.5.1 is applied whereby consideration is given to the overlapping habitat and its implications for cost attribution to bull trout.

Conservation activities designed to protect bull trout may provide coincident protection to other fish species, particularly salmon and steelhead. As noted earlier, separating and attributing costs among individual listed species is a complex exercise. Development of this analysis included investigation regarding the extent to which ordinances or regulations were initiated in deference to specific species; in the case of most local ordinances, it was not possible to discern the cost attribution with certainty. Methods of spatially analyzing the locations of section 7 consultations on bull trout (through the Service) and on salmon (through NOAA Fisheries) were also explored on the theory that a comparative analysis of the actual number of consultations for respective species may provide information on the geographic locations, activities, and conditions that prompt consultations and required conservation measures. Unfortunately, the available data did not allow for adequate spatial analyses to suggest specific consultation patterns that could be used to apportion costs.

There lacks an adequate method for properly separating the costs associated with the conservation activities among the listed species. This analysis is conducted on an individual HUC basis, and the tables show the summary for the entire region. Hence, the economic effects described in the text of this analysis are best considered as "impacts associated with co-extensive salmon and bull trout conservation activities." This terminology is used for the remainder of this section.

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97 U.S. Department of Commerce, NOAA, March 24, 1999, "Proposed Threatened Status for Three Contiguous ESUs of Coho Salmon Ranging from Oregon through Central California, Proposed Rule," *Federal Register,* Vol. 60, No. 142, pp. 38011-38030.

98 U.S. Department of Commerce, NOAA, April 15, 2004, "Establishment of Species of Concern List, Addition of Species to Species of Concern List, Description of Factors for Identifying Species of Concern, and Revision of Candidate Species List Under the Endangered Species Act," *Federal Register,* Vol. 69, No. 73, pp. 19975-19979.

99 To identify HUC watersheds that support salmon, this analysis relies on an assessment of the Puget Sound Chinook salmon population conducted by NOAA Fisheries Puget Sound Technical Recovery Team (note that the watersheds supporting Puget Sound Chinook are inclusive of those supporting Hood Canal Summer-Run chum). Their findings regarding the specific fifth-field HUC watersheds supporting 22 independent Chinook populations are detailed in the report, *Initial Assessment of NOAA Fisheries' Critical Habitat Analytical Review Teams For 13 Evolutionarily Significant Units of Pacific Salmon and O. mykiss* (November 2004).

3.2.2 FEDERAL AND STATE STATUTES AND REGULATIONS

3.2.2.1 Northwest Forest Plan

The Northwest Forest Plan (NWFP) was designed to provide sustainable use of Federal natural resources (lands managed by the USFS and the BLM) and for local timber dependent communities within the range of the endangered northern spotted owl. Constraints imposed on timber harvesting have implications for analyzing economic effects of the bull trout CHD. The NWFP area encompasses all or portions of 17 National Forests in Washington, Oregon, and California, as well as BLM managed public land in Oregon and California. In Washington State, west of the Cascades mountain range, bull trout critical habitat is found on the Mount Baker-Snoqualmie and Olympic national forests.

The Record of Decision (ROD) for the NWFP was signed in April 1994. It was based on development of a supplemental environmental impact statement (SEIS) that analyzed ten alternatives for striking a balance between timber harvest and forest habitat conservation. The ROD adopted allows for a probable annual sale quantity of 1.1 billion board feet of timber in aggregate, and regional timber employment of 115,900 jobs. The Plan amended USFS and BLM planning documents within the range of the northern spotted owl.

Land allocations and standards and guidelines from the NWFP have affected timber harvesting. Both components have the effect of removing the amount of timber available for harvest. The NWFP established new land allocations, one of which is riparian reserves. Riparian reserves comprise about 11 percent of the lands within the range of the northern spotted owl, or approximately 2.6 million acres. As defined in the Plan ROD, “Riparian reserves are areas along all streams, wetlands, ponds, lakes, and unstable or potentially unstable areas where the conservation of aquatic and riparian-dependent terrestrial resources received primary emphasis” (ROD 1994:7). The main purpose of the riparian reserves is to protect the health of the aquatic system and its dependent species.

The standards and guidelines are detailed requirements describing how land managers should manage forestlands within the range of the northern spotted owl. They also set initial widths for protected riparian areas. Riparian areas are important because they determine the amount of land where timber can be harvested. The initial boundary widths for riparian reserves are the following:

1. For fish-bearing streams, the area on each side of the stream equal to the height of two site-potential trees (the height of a tree at 100 years), or 300 feet slope distance, whichever is greater.

2. For permanently flowing non-fish-bearing streams, the area on each side of the stream equal to the height of one site-potential tree, or 150 feet slope distance, whichever is greater.

3. For seasonally flowing or intermittent streams, the area on each side of the stream to a distance equal to the height of one site-potential tree, or 100 feet slope distance, whichever is greater.

These guidelines are to remain in effect until land managers engage in a more detailed planning procedure, known as watershed analysis. Another land allocation relevant to bull trout protection is the Key Watersheds designation. Key watersheds are comprised of "Tier 1" and "Tier 2" watersheds. Tier 1 key watersheds are to be managed for at-risk anadromous salmonids, bull trout, and resident fish. These include 141 watersheds, or approximately 8.1 million acres within the range of the northern spotted owl. Tier 2 key watersheds are those where high water quality is important. These include 23 watersheds, or approximately one million acres within the range of the northern spotted owl.

The NWFP remains in effect. Annual monitoring reports are produced detailing progress made in watershed analysis, watershed restoration, and volume of forest products sold.

3.2.2.2 Habitat Conservation Plans

Under Section 10(a)(1)(B) of the Act, an entity (i.e., a landowner or local government) may develop a habitat conservation plan (HCP) for a species in order to meet the conditions for issuance of an incidental take permit.[100] The incidental take permit allows a non-Federal landowner to proceed legally with land management activities (e.g., timber harvest, mining, or resource management) that may otherwise result in the illegal take of a listed species.[101] The economic impact of an HCP includes the cost of developing the plan as well as the implementation of specific conservation activities agreed to by the landowner (conservation activities ensure that activities will not result in jeopardy to the various species covered by the plan or adverse modification to their habitat). As discussed below, this analysis focuses on the cost of implementing HCP conservation activities and does not include the cost of developing HCPs as an economic impact attributable to the protection of bull trout under the Act.

In addition to providing long-term conservation of both listed and non-listed species, HCPs provide certainty and stability for landowners in complying with the Act. For example, the incidental take agreement that accompanies the successful completion of an HCP provides landowners protection against future violation of the "take" provision of the Act, based on their adherence to the terms and conditions identified in the incidental take permit for a 50 or 100 year time frame.[102] HCPs also contain a "safe harbor" provision that encourages landowners to include all listed and non-listed species (i.e., species that may become listed in the future) in their HCP without incurring additional costs. That is, some HCP landowners have added non-listed species to their existing HCP as well as listed species that do not currently occur on their HCP lands based on the understanding that their conservation activities would also be protective of these species if (1) the species become listed at some point in the future, or (2) the species are found to occur on their lands in the future. HCPs also provide landowners with assurance that additional future mitigation will not be required, except under extraordinary circumstances.

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[100] More information on HCPs is available at http://endangered.fws.gov/hcp/.

[101] Federal entities avoid the "take" of a listed species through the section 7 consultation process.

[102] Timeframe is 50 to 100 years in most cases.

In the Federal Register Notice proposing critical habitat for bull trout, the Service has excluded from the designation lands already covered by four existing HCPs based on the belief that including these lands will provide little additional benefit to the species.[103] The Service notes, for example, that HCPs generally provide greater conservation benefits to a covered species than section 7 consultations because HCPs assure the long-term protection and management of a covered species and its habitat. In contrast, section 7 consultations often do not commit the project proponent to long-term protections (e.g., 50 to 100 years).

HCPs are most frequently developed as part of a multi-species, ecosystem approach within an identified planning area. HCPs can cover a variety of land use activities, but in the case of proposed critical habitat for bull trout, permitted activities primarily cover forest and municipal watershed management (e.g., timber harvest, road maintenance and decommissioning, culvert replacement, and reservoir level maintenance), and wastewater treatment, and state land management activities. There are six existing HCPs (four excluded from critical habitat), and five HCPs currently under development that include "take" coverage for bull trout and fall within the affected area of the analysis.[104] These HCPs are summarized in Table 9.

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103 HCP *excluded lands* include the City of Seattle Cedar River, City of Tacoma Water, Washington DNR, and Simpson Timber Company. Two other existing HCPs are on lands proposed for critical habitat (West Fork Timber and Plum Creek Timber). These two categories of effects ("excluded" and "proposed for critical habitat") will be identified separately in this analysis.

104 Two existing HCPs (Plum Creek and West Fork) cover lands within fifth-field HUC watersheds that contain proposed bull trout designated stream reaches. Although these two HCPs do not contain proposed critical habitat designated stream reaches, lands covered by these HCPs are within the boundaries of the economic analysis (e.g., HUCs).

Table 9
Existing and Ongoing Habitat Conservation Plans That Include Bull Trout within Coastal-Puget Sound Population

Name of HCP	Year Initiated[a/] (Completed)	HCP Land Status	HCP Area (Acres)[b/]	HCP Development Costs ($)	Activities Covered by Incidental Take Permit	Impact of HCP on Coastal-Puget Sound Population of Bull Trout
Washington DNR Timber Lands (Bull Trout Amendment)	1993 (1997)	Proposed for Exclusion	1,630,000	unknown	Forest Management (timber harvest, roads, culverts, etc.)	Amendment to add Coastal-Puget Sound bull trout in 1999. Among DNR's vast land holdings, bull trout found in higher elevations.
Simpson Timber (Green Diamond)	1997 (2000)	Proposed for Exclusion	254,424	unknown	Forest Management (timber harvest, roads, culverts, etc.)	Bull trout found within various portions of these HCP lands southwest of Puget Sound.
Cedar River (City of Seattle)	1994 (2000)	Proposed for Exclusion	89,935	4,000,000	Water supply, hydroelectric power generation, forest practices (timber/roads), etc.	HCP covers the entire Cedar River watershed, including the Tolt Reservoir. Bull trout only found in the reservoir and upstream tributaries and is no known to pass below the dam.
Plum Creek Timber I-90 (Bull Trout Amendment)	1994 (1996)	Proposed CHD	53,435	2,000,000	Forest Management (timber harvest, roads, culverts, etc.)	Amendment to add Coastal-Puget Sound bull trout completed in 2004, though bull trout unlikely to be found on Plum Creek lands, which are upstream from Hansen Dam (note: Green River watershed also includes Tacoma HCP).
West Fork Timber (Bull Trout Amendment) (Murray Pacific)	1993 (1995)	Proposed CHD	11,600[c/]	1,000,000	Forest Management (timber harvest, roads, culverts, etc.)	Amendment to add Coastal-Puget Sound bull trout in 2001. West Fork land holdings within the Coastal-Puget Sound are minimal, however, and include mostly high elevation tributaries above known bull trout occupied reaches. The Columbia River population of bull trout is a more significant part of this HCP.
Tacoma Public Utilities	1997 (2001)	Proposed for Exclusion	14,647	unknown	Protect watershed for drinking water; provide for fish and wildlife habitat; generate revenues through timber harvest	Note that the Green River watershed also includes Plum Creek HCP.
ONGOING HCPs[d/]						
City of Kent Water Supply	2003 (ongoing)	Proposed CHD	300	2,000,000	Municipal drinking water withdrawal	Water withdrawal point in salmon habitat area and unlikely to provide specific benefits to bull trout in the lower Cedar River watershed. Uncertainty regarding future economic effects
Dungeness Conservation and Irrigation District Management Plan	2002 (ongoing)	Proposed CHD	Unknown	950,000	Irrigation water withdrawal, irrigation ditches, canals, etc	Applies to private agricultural lands.
King County Wastewater Treatment Division	2003 (ongoing)	Proposed CHD	350,000	3,500,000	Wastewater discharge, construction, water	Applies to County's entire service area, including privately owned land. Mitigation areas likely to be located along the

Name of HCP	Year Initiated[a/] (Completed)	HCP Land Status	HCP Area (Acres)[b/]	HCP Development Costs ($)	Activities Covered by Incidental Take Permit	Impact of HCP on Coastal-Puget Sound Population of Bull Trout
					reclamation (includes riparian habitat restoration)	Upper Green River and the Sammamish River
Washington DNR Aquatic Lands	2003 (ongoing)	Proposed CHD	2,400,000	5,000,000	Authorized activities on state owned aquatic lands, including leased lands.	Includes a variety of activities requiring state authorization, (e.g., recreation, sand and gravel operation, marine and freshwater construction, etc.). Uncertainty regarding specific activities precludes estimate of economic effects.
Washington State Forest Practice Rules	2003 (ongoing)	Proposed CHD	10,000,000	Unknown	Forest Management (timber harvest, roads, culverts, etc.)	Will apply to all state and privately held timber lands. Provides incidental take coverage for those entities already following Washington's Forest Practice Rules and therefore, there are no additional costs.

a/ Start dates are approximate. Applicants often prepare in advance of initiating active involvement with the Service.
b/ Size of HCP planning area based on total area covered by HCP agreement and may includes lands outside of proposed CHD.
c/ Acres for West Fork Timber only includes area within bull trout CHD; the vast majority of this HCP agreement is within the Columbia Basin.
d/ The Snohomish County Public Works HCP started in 2002, but worked on it has stopped at this time. The draft HCP indicated that it would have covered construction, stormwater treatment, road maintenance, bank stabilization, improvements to streamside & habitat, and some restoration activities on 43,900 acres. However, the scope of the final HCP cannot be determined.

Sources: Personal communication with Service Biologist, Western Washington Fish and Wildlife Office, Lacey, Washington, June 10, 2004; personal communication with Steve Gilbert, HCP Project Manager, King County Wastewater Treatment Division, May 3, 2004, February 1, 3, and 7, 2005; personal communication with Andrew Graham, HDR/EES, (consultant to Dungeness Conservation and Irrigation District), February 1, 2005; personal communication with Service Section 6 Grants Program Staff, Olympia, Washington, February 3, 2005; personal communication with Service Biologist, Olympia, Washington, February 3, 2005; personal communication with Carol Piening, Washington State Aquatic Resource Program, ESA Compliance Team, February 3, 2005.

Economic Effects of Habitat Conservation Planning

The economic costs associated with an HCP include the cost of *developing the plan* as well as *implementing specific conservation activities* (referred to as "terms and conditions" in the incidental take permit). Both of these impacts are costs associated with the listing of the species and therefore relevant to this economic analysis. Section 3.4 of this report estimates the economic impact of implementing timber harvest-related and other HCP conservation activities (e.g., wastewater treatment, state land management activities, and water supply) that provide benefits to bull trout. Aggregate costs identified by stakeholders involved in the HCP development process are summarized below.

Cost of Developing HCPs

As shown in Table 9, the cost of HCP development varies and can be significant. The costs, which range from $1 million to $5 million, are indicative of the economic impact of multi-species HCP planning in general, rather than the cost of implementing conservation activities for specific species such as bull trout. The costs reflect the activities associated with studying the extent of habitat for listed and unlisted species within a specific HCP planning area and may also include the following types of activities:

1. Field research documenting the presence and habitat characteristics of species in the HCP area;
2. Development of biological reports summarizing the extent of habitat for a variety of species;
3. Development of technical reports detailing impact of landowner activity on listed species;
4. Development of the HCP document that detail conservation activities intended to minimize and mitigate impacts to covered species;
5. Development of public outreach brochures to explain the purpose and intent of HCP negotiations;
6. Development of associated NEPA documents (e.g., Environmental Impact Statements);
7. Development of adaptive management techniques by landowner to identify future activities and plan for future mitigation; and
8. Monitoring and implementation requirements of the HCP for the permit term.

Multi-species HCPs may include both listed and non-listed species. For example, the Simpson HCP covers five listed species (three aquatic species including bull trout, and two wildlife species) as well as an additional 46 non-listed species. The HCP framework provides incidental take permit coverage for the unlisted species if they were ever to be listed as either threatened or endangered under the Act by the Service during the 50 year time frame of the permit.

Because of the nature of multi-species HCPs, it is difficult to attribute or apportion the HCP *development costs* to a particular listed species. In contrast, the *implementation costs* associated with fish-specific conservation activities can more easily be identified in order to estimate the economic effects associated with bull trout conservation. Therefore, this report highlights the costs of the HCP development process only as a means to *illustrate* the costs associated with negotiating an HCP agreement. The HCP development cost estimates are not included in the estimate of the total economic effect of HCP protection afforded bull trout. Therefore, this analysis likely understates the economic effects associated with conservation planning under Section 10(a)(1)(B) of the Act (see Section 0 for further discussion of the costs of implementing specific HCP conservation activities).

3.2.2.3 Clean Water Act

The purpose of the Clean Water Act (CWA) is to restore the physical, biological, and chemical integrity of the waters of the United States using two basic mechanisms: (1) direct regulation of discharges pursuant to permits issued under the National Pollution Discharge Elimination System (NPDES) and section 404 (discharge of dredge or fill materials); and (2) the Title III water quality program.[105]

Under the NPDES program, the U.S. Environmental Protection Agency (EPA) sets pollutant-specific limits on the point source discharges for major industries and provides permits to individual point sources that apply these limits. EPA has delegated responsibility for the NPDES permitting program to most states.[106] State-issued NPDES permits are treated as non-Federal actions. As such, the issuance of NPDES permits by states is not subject to the consultation requirements of the Act. The Service consults with the EPA on the triennial review to ensure that threatened and endangered species impacts are contemplated in the development of standards.

Under the water quality standards program, EPA has issued water quality criteria to establish limits on the ambient concentration of pollutants in surface waters that will still protect the health of the water body. States issue water quality standards that reflect the Federal water quality criteria and submit the standards to EPA for review. State water quality standards are subject to review every three years (triennial review). States apply the standards to NPDES discharge permits to ensure that discharges do not violate the water quality standards.[107]

Under section 401 of the CWA, all applicants for a Federal license or permit to conduct activity that may result in discharge to navigable waters of the United States are required to submit a State certification to the licensing or permitting agency. Section 404 of the CWA prescribes a permit program for the discharge of dredged or fill material into navigable waters. Specifically, pursuant to section 404, permit

105 Clean Water Act, 33 U.S.C. §1251 (1987).

106 Clean Water Act, 33 U.S.C. §402.

107 Clean Water Act, 33 U.S.C. §303, 305.

applicants are required to show that they have "taken steps to avoid wetland impacts, where practicable, minimized potential impacts to wetlands, and provided compensation for any remaining, unavoidable impacts through activities to restore or recreate wetlands."[108]

The CWA will influence activities on nearly all of the proposed bull trout critical habitat units, because these activities (e.g., road/bridge construction and hydroelectric power relicensing) will require NPDES or section 404 permits and occur on or near all units. Because water quality is important to the conservation of bull trout, this statute will likely impact the extent, location, and nature of future activities on or near the proposed critical habitat units.

3.2.2.4 Growth Management Act

There are several regulations in Washington State governing development activities in locations that could potentially affect bull trout. Many of these laws, such as the Shoreline Management Act (passed in 1972) and the Hydraulic Project Approval process (started in 1949) were in place years before the Act was signed into law. In other cases, such as the Growth Management Act (passed in 1990), the law's development followed the Act but preceded the listing of bull trout. While establishment of current State regulations of development activities were initiated prior to bull trout listing, some have been amended in recent years to address concerns of salmonids, including bull trout and are therefore of particular relevance to this analysis. Major State regulations (or Federal laws administered by the State) affecting development in locations proximate to bull trout habitat are discussed below.

Hydraulic Project Approval

In 1949, the Washington Department of Fish and Wildlife (WDFW) was provided the authority to issue Hydraulic Project Approvals (HPA) for all construction activities that occur within the high water line of fresh or salt-water bodies.[109] HPAs are authorized under a State law known as the "Hydraulic Code" (Revised Code of Washington (RCW) 75.20.100-160), which was intended to protect habitat for all fish and shellfish resources in the State. Major activities that are covered by HPAs include construction of bridges, piers, and docks; gravel removal; dredging; culvert installation; and water diversions. Many other activities require HPAs as well. If a project may adversely impact fish habitat, HPA approval may be subject to certain conditions such as restrictions on the period of work and the construction methods that can be utilized.

The establishment of the Hydraulic Code and the amendments that followed did not define regulations that pertain specifically to listed species. That is, the regulations are applicable to all species, listed or

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108 U.S. Environmental Protection Agency, September 26, 2003 (last updated), "Section 404 of the Clean Water Act: An Overview," http://www.epa.gov/owow/wetlands/facts/fact10.html.

109 Washington Department of Fish and Wildlife, "Hydraulic Project Approval (HPA)," http://wdfw.wa.gov/hab/hpapage.htm, accessed May 26, 2004.

not.[110] In 1999, WDFW entered into a Memorandum of Agreement (MOA) with the Service and NMFS to develop an Act compliance agreement for HPAs issued by WDFW. However, the MOA was revoked a short period later. Consequently, the listing and proposed CHD for bull trout does not impose any additional economic burden on construction activities within the high water line under the HPA process.

Growth Management Act

The Growth Management Act (GMA) was developed in 1990. The objective of the GMA is to prevent uncoordinated and unplanned growth that poses a "threat to the environment, sustainable economic development, and the health, safety, and high quality of life enjoyed by residents of this state."[111] Under the GMA, the State provides broad public access to data and maps describing development opportunities and constraints. The Act is widely used as a framework for other State statutes and policies related to land-use practices, environmental protection, and sustainable development. It stipulates that all counties in Washington and the municipalities within them should perform at least a minimum level of development planning, including:

1. Designate and protect wetlands, frequently flooded areas, and other critical areas. Critical areas include wetlands, recharge areas for aquifers that supply drinking water, frequently flooded areas, geologically hazardous areas, and fish and wildlife habitat conservation areas.

2. Designate farm lands, forest lands and other natural resource areas.

3. Determine that new residential subdivisions have appropriate provisions for public services and facilities.

Counties with large populations and high population growth must "fully plan" under the regulations. Any political jurisdiction that is not required to fully plan under the GMA may voluntarily do so.[112] All counties within the Coastal-Puget Sound region, except Grays Harbor, are fully planning under the GMA. Fully planning jurisdictions have additional requirements than those listed above. They must: a) develop county-wide planning policies, b) assess population growth regularly, c) designate Urban Growth Areas (UGA) inside their jurisdictions, d) designate resource lands (forest, agricultural, and mineral lands) and conserve them, e) designate and protect critical areas, and f) develop comprehensive plans that include the following elements and must be updated every seven years:

- Land Use;

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[110] Personal communication with Gayle Kreitman, Regulatory Services Section Manager, Washington Department of Fish and Wildlife, June 2004.

[111] RCW 36.70A.010.

[112] Municipal Research and Services Center of Washington, February 2004, "Comprehensive Planning/Growth Management," http://www.mrsc.org/subjects/planning/compplan.aspx, accessed May 20, 2004.

- Transportation;
- Housing;
- Capital Facilities;
- Utilities;
- Shorelines; and
- Rural.

Optional items for the comprehensive plans are:

- Conservation;
- Energy;
- Recreation; and
- Sub-Area Plans.[113]

Jurisdictions that are required only to partially plan must classify, designate, and protect resource lands and critical areas; review their work on resource lands and critical areas for continuing compliance with the GMA every seven years; and ensure that development regulations such as zoning, subdivision, and other controls are consistent with their comprehensive plans, if the jurisdictions have them.[114]

The GMA regulations were amended in 1995 to explicitly state that planning by cities and counties "...shall give special consideration to conservation or protection activities necessary to preserve or enhance anadromous fisheries."[115] It is not clear if this related specifically to the Act as no other document makes this connection. However, in 2000 and 2001, the Washington Administrative Code (WAC), which stipulates how the GMA will be enacted, was amended to include, "The inclusion of the best available science in the development of critical areas policies and regulations is especially important to salmon recovery efforts, and to other decision-making affecting threatened or endangered species."[116]

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113 Washington Department of Community, Trade, and Economic Development, Growth Management Services, undated, "The Washington State Growth Management Act: An Overview," pamphlet.

114 Ibid.

115 RCW 36.70A.172, "Critical Areas – Designation and Protection – Best Available Science to Be Used."

116 WAC 365-195-900, "Background and Purpose."

The Washington State Department of Community, Trade, and Economic Development's (CTED) Growth Management Service's section is responsible for assisting in and reviewing jurisdictions' planning conducted under the GMA. Informational documents produced by the CTED in 2003 suggest that jurisdictions ensure that comprehensive plans incorporate procedures to deal with areas impacted by listings under the Act and/or the Act's 4(d) rules.[117] It is important to note that consideration of listed species is not required by the GMA. It is clear that the GMA offers some existing level of protection for bull trout through measures to protect and conserve habitat for all fish and wildlife species. However, bull trout listing and proposed CHD will not result in additional requirements under the GMA.

Stormwater Management Programs

In 1987, the U.S. Congress changed the CWA by declaring the discharge of stormwater (traditionally considered a nonpoint source of pollution) from certain industries and municipalities to be a point source of pollution requiring NPDES permits or water quality discharge permits.[118] Washington State was given authority by the EPA to implement the water quality permit. The EPA stormwater regulations establish two phases for the stormwater permit program. Phase I stormwater NPDES permits have been issued to cover stormwater discharges from selected industries, construction sites involving five or more acres, and any municipality with a population exceeding 100,000.[119]

Stormwater discharges from industries and construction sites are regulated under separate general permits that were issued by WDOE in November 1995. The permits require the development and implementation of a Stormwater Pollution Prevention Plan (SWPPP).[120] The SWPPP for construction sites is primarily a temporary erosion and sediment control plan. The SWPPP for industrial facilities is a documented plan to identify, prevent, and control the contamination of stormwater discharges.

Municipal stormwater permits require development and implementation of a Stormwater Management Program. A Stormwater Management Program is a plan for the term of the permit to reduce the discharge of pollutants, reduce impacts to receiving waters, eliminate illicit discharges, and make progress towards

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117 Washington Department of Community, Trade, and Economic Development, December 5, 2003, "GMA Update: Issues to Consider When Reviewing Comprehensive Plans and Development Regulations," http://www.cted.wa.gov/DesktopModules/Documents/ViewDocument.aspx?DocumentID=982, accessed May 25, 2004; and Washington Department of Community, Trade, and Economic Development, December 5, 2003, "GMA Update: Issues to Consider When Reviewing and Evaluating Critical Areas Regulations and Natural Resource Lands Designations," http://www.cted.wa.gov/DesktopModules/Documents/ViewDocument.aspx?DocumentID=981, accessed May 25, 2004.

118 Federal Water Pollution Control Act of 1972, Section 402 (Clean Water Act), paragraph (p), P.L. 100-4.

119 Washington Department of Ecology, "About Stormwater," http://www.ecy.wa.gov/programs/wq/stormwater/municipal/gen_info.html, accessed September 9, 2004.

120 Washington Department of Ecology, August 21, 2002, *The Industrial Stormwater General Permit*, pp. 35-41.

compliance with surface water, ground water, and sediment standards. WDOE is in the process of reissuing municipal stormwater permits and intends to reorganize the program.[121]

On October 29, 1999, the final Phase II stormwater regulations were promulgated by the EPA. Phase II regulations expand the requirement for stormwater permits to all municipalities located in urbanized areas, and to construction sites between one and five acres. The rule also requires an evaluation of cities outside of urbanized areas that are more than 10,000 in population to determine if a permit is necessary for some or all of these cities. Under the new rule, up to 90 additional municipalities in Washington may need municipal stormwater permits and the expansion of the construction site permitting requirements will affect a large percentage of sites. WDOE does not expect to develop and implement the general Phase II municipal stormwater permit until at least the fall of 2004.[122]

EPA rules require local governments to develop stormwater programs that address the following six main elements:

- Public Education and Outreach;
- Illicit Discharge Detection and Elimination;
- Post-Construction Runoff Control;
- Public Participation/Involvement;
- Construction Site Runoff Control; and
- Pollution Prevention/Good Housekeeping.[123]

2001 Stormwater Management Manual

In 2001, WDOE issued a revised *Stormwater Management Manual for Western Washington* that includes Best Management Practices intended to prevent harm to species listed under the Act.[124] One county and several cities in western Washington have since adopted the manual into their local codes. Protection of fish and wildlife is often mentioned along with other benefits in materials regarding the stormwater

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121 Washington Department of Ecology, "About Stormwater," http://www.ecy.wa.gov/programs/wq/stormwater/municipal/gen_info.html, accessed September 9, 2004

122 Ibid.

123 Ibid.

124 Washington Department of Ecology, Water Quality Program, August 2001, *Stormwater Management Manual for Western Washington*, Volume I, p. 1-8.

NPDES program. The revised *Stormwater Management Manual for Western Washington*, issued by WDOE, includes a discussion of the Act. The implication of this discussion is that WDOE cannot guarantee that adherence to the manual is equivalent to adherence to the Act.[125] In its 2003 *Report to Washington Department of Ecology*, the Western Stormwater Group indicated that, "The Puget Sound Water Quality Protection Act, State Water Pollution Control Act, and Federal Endangered Species Act all contemplate a stormwater permit program that is more robust than the minimal measures outlined by EPA."[126] Thus, while it is less clear how the Act affected implementation of the stormwater program in the past, there appears to be likelihood that it will impact stormwater permitting in the future.

Shoreline Management Act

Washington's Shoreline Management Act (SMA) was passed by the State Legislature in 1971 and adopted by the public in a 1972 referendum. The stated purpose of the SMA is "to prevent the inherent harm in an uncoordinated and piecemeal development of the state's shorelines."[127] The SMA is essentially a shoreline comprehensive plan and zoning ordinance with a distinct environmental orientation applicable to shoreline areas and customized to local circumstances.[128]

The Act requires that 39 counties and more than 200 cities having "shorelines of the state," prepare Shoreline Master Programs (SMP) based on State laws and rules but tailored to the specific geographic, economic and environmental needs of the community. These shorelines are defined as:

- all marine waters;
- streams with greater than 20 cubic feet per second mean annual flow;
- lakes 20 acres or larger;
- upland areas called shorelands that extend 200 feet landward from the edge of these waters; and
- the following areas when they are associated with one of the above:
- biological wetlands and river deltas; and
- some or all of the 100-year flood plain including all wetlands within the 100-year flood plain.

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125 Ibid., pp. 1-13 through 1-15, and 1-21 through 1-22.

126 Westside Stormwater Group, December 1, 2003, *Report to the Washington Department of Ecology*, p. 28.

127 RCW 90.58.020.

128 Washington Department of Ecology, "Introduction to the Shoreline Management Act," http://www.ecy.wa.gov/programs/sea/SMA/st_guide/intro.html, accessed September 9, 2004.

The SMA also states that "the interests of all the people shall be paramount in the management of shorelines of statewide significance." These shorelines are defined in the SMA as:

- Pacific Coast, Hood Canal and certain Puget Sound shorelines;
- all waters of Puget Sound and the Straight of Juan de Fuca;
- lakes or reservoirs with a surface acreage of 1,000 acres or more;
- larger rivers (1,000 cubic feet per second or greater for rivers in Western Washington, 200 cubic feet per second and greater east of the Cascade crest); and
- wetlands associated with all the above.[129]

The SMA gives preference to uses that:

- Protect the quality of water and the natural environment;
- Depend on proximity to the shoreline; and/or
- Preserve and enhance public access or increase recreational opportunities for the public along shorelines.[130]

Unlike the GMA, SMPs developed by local jurisdictions must be approved and permitted by WDOE before they can take effect.[131]

In 2000, WDOE adopted new Shoreline Management Guidelines.[132] These guidelines were developed in cooperation with the Service and NMFS. Following the guidelines would have allowed jurisdictions to be compliant with the Act according to the Service and NMFS.[133] However, the guidelines appeared to the business community and many jurisdictions to be too restrictive. In 2001, the Washington State Shoreline Hearings Board agreed and invalidated the new guidelines. Following this, WDOE developed

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[129] Ibid.

[130] Ibid.

[131] Ibid.

[132] Under WAC 173-26.

[133] Personal communication with Peter Skowlund, Washington Department of Ecology, May 27, 2004.

revised guidelines, which were finalized in June of 2003.[134] According to an author of the current guidelines, they no longer address issues related to the Act. Consequently, local jurisdictions following the guidelines are therefore not necessarily protected from suits under the Act.[135]

Much of the stream and marine habitat utilized by bull trout are covered under the SMA. Therefore, the SMA provides some existing level of protection to bull trout and all fish and wildlife species. However, because the SMA was not developed to specifically address concerns surrounding listed species, the bull trout listing and CHD does not result in any additional costs under the Act. Consequently, this analysis does not estimate costs associated with burdens imposed by the SMA.

Salmon Recovery Act

The Washington State Legislature passed the Salmon Recovery Act in 1998 partly due to the State's unsuccessful efforts to prevent the listing of various salmon stocks under the Act. The Act creates three State-level offices to oversee salmon recovery efforts and provide funding. The Governor's Salmon Recovery Office is intended to "provide overall coordination of the state's response," while the Independent Science Panel provides scientific review and oversight. The Salmon Recovery Funding Board administers funds for recovery. Local jurisdictions and tribes provide "leadership in identifying and sequencing habitat projects to be funded by state agencies," and to start habitat improvement projects "without delay," and to "allow citizen volunteers to work effectively."[136]

The statute does not require the participation of private entities. Rather, the intent is to create voluntary public-private partnerships for recovery efforts.[137] The statute requires, as NOAA Fisheries does, that recovery efforts occur on an ESU basis. Following this, the State developed ESU-wide regional salmon recovery organizations. The two that are relevant for the present study are the Puget Sound and Washington Coastal Salmon Recovery Regions.[138]

In 1999, the Puget Sound region members agreed on a plan described in the document, *Shared Strategy for Recovery of Salmon in Puget Sound,* which NOAA Fisheries has committed to use in developing

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[134] King County, August 26, 2003, "Shoreline Master Program Update: Shoreline Management in Washington State: A Legislative and Regulatory History as it Relates to King County," http://www.metrokc.gov/ddes/MP/SMAHistory.shtm, accessed May 24, 2004; personal communication with Peter Skowlund, Washington Department of Ecology, May 27, 2004.

[135] Personal communication with Peter Skowlund, Washington Department of Ecology, May 27, 2004.

[136] Engrossed Substitute House Bill 2496; and RCW 77.85.005. http://www.leg.wa.gov/RCW/index.cfm?section=77.85.005&fuseaction=section.

[137] RCW 77.85.050; http://www.leg.wa.gov/RCW/index.cfm?fuseaction=chapterdigest&chapter=77.85.

[138] State of Washington, Governor's Salmon Recovery Office, February 19, 2004, "Salmon Recovery Regional Organizations," http://www.governor.wa.gov/gsro/regions.htm, accessed June 30, 2004.

recovery plans for Puget Sound salmon. The plans focus on setting instream flows and/or addressing human and natural resource water needs. The final recovery plan is due to be submitted to the Governor's Salmon Recovery Office in Summer 2005. Once submitted to NOAA Fisheries, draft recovery plans must be filed in the Federal Register to allow for public comment before NOAA Fisheries can adopt them as an approved recovery plan. NOAA Fisheries may make other changes as well to draft recovery plans before they can be considered approved plans.[139]

3.2.3 ELEMENTS OF THE RECOVERY PLAN

The Coastal-Puget Sound population of bull trout was proposed for listing as "threatened" under the Endangered Species Act in June 1998. The final rule was issued on November 1, 1999. The Service prepared a draft recovery plan for bull trout that identifies the limiting factors to bull trout recovery and reasonable actions that are necessary to recover and/or protect the species.

The Coastal-Puget Sound population was divided into two management units which are addressed separately within the draft recovery plan. The Olympic Peninsula Unit is further divided into six core areas with ten current local populations and two potential local populations. The Puget Sound Unit contains 57 local populations and five potential local populations in eight core areas.

Below is a general description of the major historic and current land and water use activities listed in the recovery plan as reasons for the decline of bull trout. These activities are also the most likely to be affected by bull trout listing and critical habitat designation within the Coastal-Puget Sound population.

- Dams
- Water Diversions
- Forest Management Practices
- Agriculture and Grazing
- Transportation Networks
- Urban Development
- Fisheries Management

These land and water use activities can impact bull trout in a variety of ways. For example, dams and water diversions can hinder bull trout recovery efforts by limiting migration and contributing to water quality problems. Transportation networks and forest management practices can also affect water quality through increased sedimentation, impassable barriers (e.g., culverts), channel constriction, and impervious surfaces.

The primary goal of the recovery plan is to "ensure the long-term persistence of self-sustaining, complex, interacting groups of bull trout distributed across the Coastal-Puget Sound Distinct Population Segment,

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139 State of Washington, Governor's Salmon Recovery Office, February 19, 2004, "Puget Sound Salmon Recovery Region," http://www.governor.wa.gov/gsro/regions/puget.htm, accessed June 30, 2004.

so that the species can be delisted."[140] The objectives of the recovery strategy identified in the recovery plans are as follows:

- Maintain current distributions of bull trout and restore distributions in some previously occupied areas;
- Maintain stable or increasing trends in adult bull trout abundance;
- Restore and maintain suitable habitat conditions for all life-history stages and strategies; and
- Conserve genetic diversity and provide opportunity for genetic exchange.

The recovery plans also identify specific criteria to assess the success of recovery actions. These criteria identify population numbers within the management unit and each core area that have been deemed necessary to support viable bull trout populations. Recovery criteria also include increasing trends in bull trout abundance based upon 10 to 15 years of monitoring data and restoration of connectivity between populations that have been segmented by dams.

The Recovery Team identified specific tasks to remove the threat to bull trout in each of the management units. Tasks with particular relevance to this study are the following:

- Improve or remove unstable or problem roads causing sediment delivery;
- Improve road maintenance practices;
- Maintain and improve streamflows;
- Eliminate or minimize entrainment at diversion ditches;
- Provide adequate fish passage around diversion dams;
- Identify and eliminate culvert barriers;
- Provide non-intrusive flood control and flood repair activities;
- Provide sufficient instream flow downstream from dams and diversions;
- Minimize levels of effective impervious surfaces from development; and

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[140] U.S. Fish and Wildlife Service, 2004, *Draft Recovery Plan for the Coastal-Puget Sound Distinct Population Segment of Bull Trout (Salvelinus confluentus),* "Volume I (of II): Puget Sound Management Unit," Portland, Oregon, p. vii.

- Reduce impacts of development and transportation corridors along estuarine and marine shorelines.

Under each of these tasks, the Recovery Plan identifies specific examples of locations and facilities within the proposed designation that represent impediments to bull trout recovery. It should be emphasized, however, that the Recovery Plans outline actions that the Service believes are necessary for bull trout protection, but that many of the actions are mandated through processes under the Act.

3.3 EFFECTS ON RESIDENTIAL AND COMMERCIAL DEVELOPMENT

Section 2.3.2.1 of this report describes a general framework for estimating the costs of land use restrictions imposed by bull trout conservation activities on landowners and developers. The framework lays out procedures for estimating two types of economic effects on development: those associated with reductions in the supply of developable land and those associated with added development costs (project modifications). This section of the analysis applies the framework to the Puget Sound portion of the population to estimate the costs to residential, commercial, and industrial development of implementing new minimum stormwater control requirements associated with bull trout conservation activities. The focus on the Puget Sound portion is motivated by the high population and development growth the region has experienced, and this growth is expected to continue in the future. Because the conservation activities associated with bull trout in Puget Sound do not remove any land from development, it is assumed here that they do not impose costs directly on landowners. Thus, there is no need to analyze the effects of bull trout conservation activities on property values (see 2.3.2.1 Framework for Residential and Commercial Development Effects). However, developers may transfer part or all costs of project modifications to land owners or consumers by offering lower land prices to land owners or increasing housing prices to consumers. The following section first discusses the data sources and then presents the estimation results for the costs associated with bull trout conservation activities.

3.3.1 DATA AND ASSUMPTIONS

As discussed in Section 2.3.2.1, estimating the costs of project modifications for developers requires three pieces of information: a) projected acres of development by HUC and by type of development, b) percent of development likely to be affected by the requirements, and c) per-acre costs of likely project modification for the affected development.

3.3.1.1 Development Projection

Projections on residential and commercial development from 2005 to 2024 for use in the prospective cost estimation are made for each HUC based on population forecasts. The Washington Office of Financial Management provides population projections in five-year intervals for each county from 2005 to 2025 (see Table 10). Based on these population projections, the annual growth rates are calculated for each county from 2005 to 2025. Acres of commercial and residential development in each year from 2005 to

2025 are estimated for each HUC by assuming that commercial and residential development will grow at the same rate as population in the counties where each HUC is located.

Table 10
Projected Annual Population Growth Rates by County, 2005 to 2025

County	2005-2010	2010-2015	2015-2020	2020-2025
Island	1.53%	1.62%	1.54%	1.38%
King	0.82%	0.84%	0.80%	0.72%
Kitsap	1.75%	1.80%	1.73%	1.54%
Pierce	1.26%	1.28%	1.21%	1.09%
Skagit	1.82%	1.85%	2.08%	1.84%
Snohomish	1.80%	1.72%	1.68%	1.50%
Thurston	2.02%	2.06%	1.73%	1.54%
Whatcom	1.61%	1.75%	1.54%	1.39%

Source: State of Washington, Office of Financial Management, "Washington State County Growth Management Population Projections, 2000-2025."

3.3.1.2 Attributing Development Costs to Stormwater Management and the Act

This analysis assumes that no development costs associated with adopting WDOE's *Stormwater Management Manual for Western Washington*, or other local codes associated with the bull trout listing, have occurred, or will occur, until January of 2005. After that point, all development in all Puget Sound counties containing critical habitat will incur incremental costs over and above the costs of their previous development codes and regulations for adopting the 2001 Manual or other new codes associated with the bull trout listing. This decision is based on the following:

Reasons development costs arising from the bull trout conservation activities are not applied prior to 2005:

- Until the Memorandum of Understanding in 1999, there was no explicit relationship between the CWA and the Act.
- Until 2001, and the Stormwater Management Manual for Western Washington, there was no Washington stormwater program that explicitly dealt with the Act and the listings of salmon in western Washington under the Act.
- Only Jefferson County and nine small municipalities have yet adopted the 2001 Stormwater Management Manual.

- Of these jurisdictions, several have indicated the adoption was not expected to result in significant costs due to the nature of the jurisdictions.

- According to State law, any areas on which preliminary plats were approved prior to 2001 may be developed according to the previous regulations as long as the construction is complete within five years.[141] For short plats, there is no time limit on when the construction must be complete for the previous regulations to apply.[142] This means that much of the construction performed after 2001 is likely to still be covered by stormwater regulations in effect prior to 2001.

- While it is likely that Seattle adopted their 2000 stormwater regulations in part due to listings under the Act, this is not explicitly stated in the regulations, nor was bull trout the species of concern at the time.[143]

Reasons development costs are assumed for 2005 and beyond:

- The 2001 Stormwater Management Manual implies that at least some protection from Act-based suits can be obtained by adopting the Manual into local jurisdictions' development codes.

- The WDOE intends to start issuing revised stormwater permits in 2005.[144]

- The WDOE will likely attempt to make the receipt of a stormwater permit dependent on jurisdictions' adoption of the 2001 Stormwater Management Manual.[145]

- While it is not certain that the permitting process will start in 2005, nor that WDOE will be successful in requiring the adoption of the 2001 Stormwater Management Manual, this analysis makes the above assumptions in order to assess all costs potentially associated with adoption of the Manual.

Costs of Implementing New Stormwater Control Requirements

The costs to residential, commercial, and industrial development as a result of more stringent stormwater management requirements are estimated using the data and assumptions discussed above. The updated

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141 Personal communication with Ed O'Brien, Washington Department of Ecology, June 1, 2004; personal communication with Brad Feilberg, City Engineer, City of Monroe, June 1, 2004.

142 Personal communication with Ed O'Brien, Washington Department of Ecology, June 1, 2004.

143 City of Seattle. 2002(?), Seattle's Stormwater Management Program, in *Seattle's Urban Blueprint Document*, http://www.pan.ci.seattle.wa.us/salmon/blueprintdoc.htm, accessed May 27, 2004.

144 Personal communication with Ed O'Brien, Washington Department of Ecology, June 1, 2004.

145 Personal communication with Ed O'Brien, Washington Department of Ecology, May 26 and June 1, 2004.

manual reflects changes in threshold levels for selection of Best Management Practices, increased flow control requirements, and a requirement for enhanced treatment of discharges. The general estimation procedure is described below.

Step 1: Estimate the current acreage of residential, commercial, mixed, and other development within the proposed bull trout CHD in the Puget Sound region. Currently developed acreage within each HUC was identified through the use of GIS analysis of land use data. The GIS coverage (Gap Analysis) was obtained from an analysis completed by the University of Washington in 1997.[146] The coverage allocates land among nine general categories including development. Developed acres are further divided into seven subcategories. The seven subcategories were allocated to four categories as shown in Table 11.

Table 11
Aggregation of Gap Analysis Land Use Data

Gap Land Use Classification	Residential	Commercial	Mixed	Other
All Types			X	
Primarily Residential	X			
Primarily Business/Industrial		X		
Mining				X
Roads				X
Mowed Grass (e.g., Golf Course)				X
Planted Trees (e.g., City Parks)				X

Step 2: Estimate the acreage of residential, commercial, mixed, and other development each year from 2005 to 2024 based upon current land use and population. As described above, the acreage of current development was calculated through GIS analysis. Table 12 presents a summary of currently developed acreage by category within the Puget Sound region.

Projected population growth rates for each county containing critical habitat were applied to the current acreage of development within each HUC to estimate annual development throughout the 2005 to 2024 period. Some HUCs are contained within more than one county. In these cases, the growth rates for each county were applied to the HUC according to the proportional share of land contained within each county. Development is assumed to continue in the same proportion as current land use within each HUC. An average of 5,799 acres across all development categories is forecasted to be developed each year within HUCs containing critical habitat.

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[146] Cassidy, K. M., January 1997, "Land Cover of Washington State: Description and Management," Washington Cooperative Fish and Wildlife Research Unit, University of Washington.

Table 12
Developed Acreage by Current Land Use Category within HUCs Containing Proposed Critical Habitat, Puget Sound

Land Use Category	Acres
Residential	405,106
Commercial	39,699
Mixed	6,810
Other	15,999
TOTAL	**467,614**

Source: NEA analysis based upon GIS coverage from Washington Department of Fish and Wildlife, Gap Analysis Program (GAP), obtained from http:// www.wdfw.wa.gov/wlm/gap/dataprod.htm.

Step 3: Estimate the costs of adhering to the stormwater management guidelines. Costs of implementing the new minimum stormwater control requirements for new developments and redevelopments were obtained from the Herrera Environmental Consultants Report commissioned by the WDOE. The Herrera Report contains information on the implementation costs based on the 1992 and 2001 standards for six development scenarios: 10-acre residential with infiltration, 10-acre residential without infiltration, 1-acre commercial with infiltration, 1-acre commercial without infiltration, 10-acre commercial with infiltration, and 10-acre commercial without infiltration. According to the report, the minimum requirements include provisions for controlling erosion and sediment transport during construction, as well as permanent facilities for treating and controlling peak runoff flows from development sites. The cost analysis considers only the stormwater system components required for erosion and sediment control, stormwater treatment, and stormwater detention and/or infiltration that goes beyond conventional stormwater systems.

Based on the Herrera report, the average (additional) cost per acre of implementing the 2001 minimum stormwater control requirements for residential and commercial developments was estimated to be $1,600 and $73,000, respectively. The total implementation costs for 1-acre commercial development without infiltration increased from $41,000 under the 1992 standards to $570,000 under the 2001 standards. Based on discussions with the WDOE and review of the report, this analysis determined that this scenario reflects an outlier that should be excluded for cost calculations. For mixed development, the average cost per acre of implementing the 2001 minimum stormwater control requirements for residential developments was estimated to be $7,312. This cost is estimated based on the current ratio of commercial and residential development. According to the current land use data, commercial and residential development accounts for 8 and 92 percent of total development, respectively. The costs applied in this analysis are summarized in Table 13.

Table 13
Per Acre Costs by Land Use Category

Land Use Category	Stormwater Management Costs ($/acre)
Residential	$1,600
Commercial	$73,000
Mixed	$7,323
Other	$0

Step 4: Estimate the present value of stormwater management costs from 2005 to 2024 using data developed in the above steps. The average annual costs to development activities over the prospective period is calculated by summing the costs incurred in each year and dividing by number of years in the prospective analysis period.

Step 5: Adjust the estimated present value of stormwater management costs in "nearshore marine habitat HUCs" to reflect the fact that inland developments are unlikely to incur costs associated with the proposed designation. Therefore, apply half the estimated development costs to "nearshore marine habitat HUCs." Total prospective costs are calculated by discounting the average annual costs using discount rates of three and seven percent.

3.3.2 Costs of Project Modifications and Improvements

The costs of implementing the new minimum stormwater control requirements are estimated using the data and assumptions discussed above. Table 14 reports prospective costs from 2005 to 2024. The costs used in this calculation reflect the incremental costs between the 1992 standards and the 2001 standards. It is assumed that the 1992 standards would have been implemented without bull trout conservation activities. Thus, only the incremental costs due to the 2001 standard can be attributed to bull trout conservation activities.[147]

Based on the projected development from 2005 to 2024, bull trout conservation activities are anticipated to increase the total cost of commercial, residential, and mixed development by $26.2 million annually. Total prospective costs are $277.2 million applying a seven percent discount rate. The majority of this cost burden (over 75 percent) falls on the commercial sector.

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147 In the calculation, the total implementation costs for 1-acre commercial development without infiltration were excluded. As reported in the Herrera report, these costs increased from $41,000 under the 1992 standards to $570,000 under the 2001 standards. Based on discussions with the Washington Department of Ecology and review of the report, this scenario reflects an outlier scenario that should be excluded for cost calculations.

Table 14
Potential Economic Impacts to Development Associated with Co-Extensive Salmon and Bull Trout Conservation Activities

Coastal-Puget Sound	Retrospective (Total)	Prospective (Total)		Prospective (Annualized)[a/]
		3%	7%	
Proposed Critical Habitat	$0	$389,242,000	$277,173,000	$26,163,000
Proposed for Exclusion	$0	$0	$0	$0
Excluded	$0	$0	$0	$0

[a/] For "nearshore marine habitat HUCs," prospective annual costs assume 25 percent of the costs otherwise estimated through the methodology described above.

3.3.3 An Alternate Approach: Stormwater Permits and Development

To validate the economic effects forecasted by the population-based development impacts analysis presented above, this analysis considers historic data on NPDES construction stormwater general permits from the WDOE ("stormwater permits"). Federal regulations promulgated by EPA require an NPDES permit for construction activities that will disturb five or more acres of land and will be discharging directly to surface waters, or indirectly through municipal storm drains. The WDOE administers the program. Development proponents are generally notified by local municipalities of the need to obtain a state-issued stormwater permit prior to development.[148] The goals of the stormwater regulations are, among other things, to eliminate water quality standards violations caused by stormwater discharges, and to establish a stormwater permit system for municipalities with over 100,000 in population, as required by EPA.

Since 2000, nearly 1,100 construction sites have been permitted through the WDOE permitting program. Though permit data do not allow for analysis by development type, these permits generally cover residential, commercial, and industrial development.

To compare the extent and location of development forecasted by the population-based model described above, this analysis estimates the extent of historic development based on the location of stormwater permit applications. Specifically, it estimates and apportions permits to individual HUCs on an annual basis as follows:

1. Identify the number and location of historic stormwater permits based on construction site zip codes. Data were obtained from the Water Quality Permit Life Cycle System (WPLCS) through

[148] In addition to construction stormwater general permits, some large developments (100+ acres) may instead be covered under an individual NPDES stormwater permit. However, based on discussion with WDOE personnel, there have been less than 10 of these permits in the last several years.

the WDOE website.[149] Of the 1,089 permits entered into the database between approximately January 2000 and October 2004, a total of 1,069 entries contain reliable data on site zip code.

2. Assume the spatial distribution of permits over last five years has not changed significantly.

3. Apportion permits statewide on a zip-code basis and determine the percentage of permits statewide occurring within bull trout HUCs in the Coastal-Puget Sound region.

4. Estimate the annual number of permits based on five years of data. Average annual number of permits between 2000 and 2004 range from 111 (2001) to 355 (2004 partial). Based on discussion with WDOE personnel, permit data within the database have been more reliable in recent years.[150] Therefore, this analysis estimates an adjusted average annual number of construction stormwater permits of approximately 350.

5. Apportion adjusted average annual permits to bull trout HUCs based on statewide percentages. Distributing the 350 statewide permits results in approximately 203 within HUCs with proposed critical habitat.[151]

6. Map the annual number and location of historic stormwater permits per HUC relative to the economic effects predicted by the population-based development model described above (see Map 10 in the Map Attachment).

The results of the analysis of historic NPDES stormwater permits appear to support the reliability of the population-based approach used to predict future development-related economic effects. To a large extent, the stormwater permit analysis confirms that the population-based approach closely matches both the location and the extent of development, based on historic patterns. As shown in Map 10, the watersheds with expected high economic effects as predicted by the population-based development model coincide with watersheds that have in the past supported high levels of historic development.

3.4 Effects on Hydroelectric Projects and Other Water Storage Dams

Hydroelectric and non-hydroelectric dams are important aspects of the economy in the Coastal-Puget Sound region. The approximately 360 hydroelectric facilities in the Pacific Northwest provide from 55 to

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149 Obtained from Washington Department of Ecology, http://www.ecy.wa.gov/programs/wq/permits/wplcs/index.html, accessed October 27, 2004.

150 Personal communication with Linda Matlock, WDOE Water Quality Program, Stormwater Unit Manager, Lacey, Washington, November 17, 2004.

151 Where percentages apportion less than one-full permit to an individual HUC, costs are rounded to zero.

70 percent of the area's power needs.[152] Located on or near streams within the proposed critical habitat in the Coastal-Puget Sound region there are 28 distinct hydroelectric projects that include 30 dams.[153] All of the operating hydroelectric facilities in the Coastal-Puget Sound population are regulated by the Federal Energy Regulatory Commission (FERC) under authority of the Federal Power Act (FPA) and are owned either by public utilities such as Seattle City Light, and Tacoma Power, or by private producers.[154]

The majority of the hydroelectric facilities in the Coastal-Puget Sound were constructed in the middle of the 20th century. Very few facilities have been constructed in recent decades due primarily to environmental concerns and relatively few suitable locations. The hydroelectric dams have been constructed on a wide variety of stream sizes and range greatly in height and generating capacity. Of the 30 dams, 12 are higher than 100 feet while 17 facilities are less than 20 feet in height. Reported generating capacities range from 100 KW to nearly 800 MW.[155]

Non-hydroelectric dams in the area were constructed primarily for flood control, recreation, and water supply for municipal and industrial uses. Dams and diversions associated with agricultural and road projects are addressed within other sections of this report. There are approximately 198 non-hydroelectric dams in the proposed critical habitat. Of these, 51 are primarily used for municipal and industrial water supply, 39 for flood control, and 102 for recreational and other uses. The majority of non-hydroelectric dams are relatively small structures that are privately owned. Non-hydroelectric dams in the CHD vary from 0 to 350 feet in height and have reservoir storage capacities between 10 and 175,000 acre-feet. Chittenden Locks on Lake Washington is used for navigation and impounds 458,000 acre-feet.[156]

Both hydroelectric and non-hydroelectric dams can impact bull trout by blocking or hindering upstream migration of adult fish to spawning habitats, and by blocking downstream migration of both juveniles and adults to rearing and foraging habitat. The lack of suitable fish passage can segment bull trout populations, thereby decreasing the genetic diversity in a particular stock. Changes in flow and water temperature can also encourage population growth in competing nonnative species. In addition, dams with lock systems or hydroelectric turbines may entrain and/or injure migrating salmonids, while high-head dams can subject the fish to gas supersaturation. Water diversion and release schedules at dams can also detrimentally impact bull trout by altering water flows that create zones of inhospitable temperatures.

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152 Northwest Power and Conservation Council, July 14, 2004, "Power Plants in the Pacific Northwest: Including Canadian Hydropower Projects in the Columbia River Basin," (spreadsheet), Portland, Oregon. National Hydropower Association, "Hydro Facts: Hydropower: A Popular Electricity Option," http://www.hydro.org/hydrofacts/popular_choice.asp, accessed February 14, 2005.

153 Bonneville Power Administration, n.d., Pacific Northwest Hydrosite Database (NWHS).

154 Bonneville Power Administration, n.d., Pacific Northwest Hydrosite Database (NWHS).

155 Ibid.

156 U.S. Army Corps of Engineers, 1998 (last updated), "National Inventory of Dams," http://crunch.tec.army.mil/nid/webpages/nid.cfm; and Washington Department of Fish and Wildlife, Science Division, Habitat Program, 2004, "WDFW Fish Passage and Diversion Screening Inventory - Dams without Fishways."

3.4.1 Effects on Hydroelectric Projects

The FPA gives FERC the authority to license hydroelectric facilities. The licensing and relicensing processes are frequently the Federal nexuses that lead to consultations with the Service and that often trigger modifications to dam operations or facilities due to the Act.[157] In the relicensing process, FERC is required by the FPA to address not only the need for power, but also recreation, tribal treaty rights, and environmental considerations. Additionally, under Section 18 of the FPA, the Service retains the authority to require fish passage at hydroelectric facilities, regardless of the license status of the facility.[158] In addition to construction of fish passage facilities, other project modifications may be required by FERC during relicensing for protection of the bull trout and other species. Commonly required activities include installation of intake screens to prevent fish from going through turbines, trapping and hauling out-migrating juvenile fish around dams, changes in ramping rates,[159] water spills to assist fish during downstream migration periods, minimum instream flows, habitat restoration activities, and research and monitoring activities.

3.4.1.1 Hydroelectric Projects in the Coastal-Puget Sound Region

A database of all Federally licensed hydroelectric projects in the Pacific Northwest was obtained from the Bonneville Power Administration (BPA) to identify the potentially affected hydroelectric facilities in the Coastal-Puget Sound critical habitat area.[160] The BPA database contains location information that allowed the dams to be mapped using GIS software. This information was then intersected with the proposed CHD for the Coastal-Puget Sound population of bull trout to identify those dams that fall within the analysis region.

The analysis was limited to: a) dams for which at least one of the purposes was the production of electricity, and b) dams that were physically functioning as of May 19, 2004, the date of the BPA database, regardless of whether or not the dam was producing electricity. These dams were selected using fields in the database indicating the current physical status and the purposes of each facility. This process identified 30 facilities in the Olympic Peninsula and Puget Sound units.

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157 Federal Power Act, 16 USC 791-828c.

158 Federal Power Act, 16 USC 791-828c; U.S. Fish and Wildlife Service and NOAA Fisheries, 2000, "Notice of Proposed Interagency Policy on the Prescription of Fishways under Section 18 of the Federal Power Act," *Federal Register*, Vol. 65, No. 247, pp. 80898-80904; and Federal Energy Regulatory Commission, August 3, 2003, "Exemptions from Licensing," http://www.ferc.gov/industries/hydropower/gen-info/exemptions.asp, accessed June 23, 2004.

159 Ramping rates refer to the period over which flows through the dam are adjusted for power generation purposes.

160 Bonneville Power Administration, May 19, 2004, Pacific Northwest Hydrosite Database (NWHS). Information in the database is updated daily (personal communication with Steve Bellcoff, Bonneville Power Administration, Portland, Oregon, January 3, 2005).

The operating hydroelectric facilities range in capacity from slightly more than 100 KW at the Diamond Creek Dam in Whatcom County to 798 MW at the Ross Dam on the Skagit River, also in Whatcom County. Total hydroelectric capacity at the 30 dams is about 4,678 MW, enough power to supply roughly 1.4 million to 3.1 million households. Seattle City Light operates the three highest capacity dams, including Ross, Gorge Lake, and Diablo Dams which form the Skagit River Complex (2,326 MW combined). Seattle City Light also runs the South Fork Tolt River Dam (74 MW) and the Newhalem Creek Dam (18 MW). Snohomish County Public Utility District (PUD) runs the Henry M. Jackson Dam on the Sultan River with a capacity of 436 MW, the next highest capacity hydroelectric facility. Puget Sound Energy operates both the Snoqualmie Falls (105.7 MW combined) and the Baker River complexes, (623 MW combined), as well as the Electron Dam (166 MW), and the recently decommissioned White River Dam with a former capacity of 272 MW. Tacoma Power's Cushman Project has a combined capacity of 330 MW. The City of Centralia, the Cities of Tacoma and Aberdeen, Snohomish County Public Utility District No. 1, and Tacoma Power operate the remaining larger facilities. Table 15 lists the dams included in the cost analysis. The following section describes the cost estimation methodology applied to the 30 hydroelectric dams.

Costs Estimation Methods

The following procedures were used to determine the costs of bull trout conservation measures at hydroelectric facilities:

The types of conservation measures included in the analysis were determined from interviews with dam owners and a review of available literature, including biological opinions associated with section 7 consultations of hydroelectric dams.[161] Common conservation measures identified included:

- Installation of fish screens over water intakes.
- Provision of fish passage, including fish ladders and trap and haul operations.
- Research and monitoring of fish abundance and health.
- Habitat modifications, including distribution of sand, gravel, and woody debris.
- Re-operation of the dam to ensure adequate instream flows for fish.

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[161] One public comment received on the draft version of this analysis asserted that voluntary efforts should not be considered in the cost estimation procedures. However, this analysis quantifies the costs of conservation efforts that benefit bull trout. The reasons contributing to the undertaking of voluntary conservation efforts may include consideration of the potential critical habitat for the species; that is, these actions may be precipitated in some part by consideration of the listing and/or critical habitat for the bull trout. For example, the City may "voluntarily" undertake habitat restoration, land acquisition, and research in response to the listing of the Chinook salmon and bull trout under the ESA. The DEA assumes that those actions would not have been pursued but for the existence of the listed species and/or their habitat.

Dam owners were interviewed to obtain actual and projected costs for bull trout conservation measures, if any. The costs incurred by each dam for these activities were assigned to the dam in question. It was not possible to interview the owners of all 29 dams for this study. In addition, some owners interviewed were uncertain of the future conservation measures that would be required. In these cases, it was necessary to determine which hydroelectric facilities are likely to be required to implement conservation measures. To assign costs to each dam, an average cost per conservation measure was determined from the costs obtained in the interviews and published literature. Average costs were determined for each of these activities for capital modifications and operations and maintenance (O&M). Costs obtained from the literature review were adjusted to current dollars using the GDP Implicit Price Deflator.[162]

Fish Screens: The BPA database contains a field indicating whether the dam has or is in need of fish screens. In addition, the Recovery Plans identify dams that are in need of fish screens on water intake structures. Average costs associated with fish screens identified during the interview process and in published literature were assigned to dams that were listed as needing fish screens in the BPA database or the Recovery Plans.

Fish Passage: The BPA database contains a field indicating whether the dam is in need of fish passage facilities. Average capital and O&M costs were assigned to dams that were identified as requiring fish passage in the database or in the Recovery Plans. The BPA database contains a field in which capital costs for fish passage at specific dams are indicated. In addition, capital costs for fish passage were available from FERC documents and interviews. The average capital cost for fish passage was determined by combining the cost data from the FERC documents and interviews with the cost data available for 295 dams in the BPA database, and calculating the median cost per foot of dam height.

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[162] U.S. Department of Commerce, Bureau of Economic Analysis, August 27, 2004, Gross Domestic Product: Implicit Price Deflator.

Table 15
Hydropower Facilities in the Proposed Coastal-Puget Sound Bull Trout Critical Habitat

Facility Name	Stream	County	Facility Owner/Operator	Capacity (MW)	Interview Completed
Cedar Falls	Cedar River	King	Seattle City Light	30.0	Yes
Cushman No. 1 (Cushman Complex)	N. Fork Skokomish R.	Mason	Tacoma City Light	50.0	Yes
Cushman No. 2 (Cushman Complex)	N. Fork Skokomish R.	Mason	Tacoma City Light	81.0	Yes
Diablo (Skagit River Complex)	Skagit River	Whatcom	Seattle City Light	152.8	Yes
Diamond Creek	Diamond Creek	Whatcom	Private Individual	0.0	No
Ebey Hill	Tributary of N. Fork Stillaguamish River	Snohomish	Private Individual	0.1	No
Electron	Puyallup River	Pierce	Puget Sound Energy	25.5	No
Elwha Dam (Elwha Restoration Proj.)	Elwha River	Clallam	USBR and NPS	14.8	Yes
Excelsior	Excelsior Creek	Snohomish	Skykomish River Hydro	0	No
Falls Creek	Falls Creek	Clallam	Clallam Co. Environmental Dept.	0.04	No
Glines Canyon (Elwha Restoration Proj.)	Elwha River	Clallam	USBR and NPS	13.3	Yes
Gorge Lake (Skagit River Complex)	Skagit River	Whatcom	Seattle City Light	158.8	Yes
Henry M. Jackson	Sultan River	Snohomish	Snohomish Co. PUD No. 1	111.8	No
Koma Kulshan	Rocky Creek	Whatcom	Koma Kulshan Associates	12.0	No
Lower Baker Dam (Baker River Complex)	Baker River	Skagit	Puget Sound Energy	79.3	No
Morse Creek	Morse Creek	Clallam	City of Port Angeles	0.5	No
Newhalem Creek	Newhalem Creek	Whatcom	Seattle City Light	2.1	Yes
Port Townsend Mill	Big Quilcene River	Jefferson	Port Townsend Paper Co.	0.4	No

Table 15 (continued)
Hydropower Facilities in the Proposed Coastal-Puget Sound Bull Trout Critical Habitat

Facility Name	Stream	County	Facility Owner/Operator	Capacity (MW)	Interview Completed
Rocky Brook	Rocky Brook	Jefferson	Rocky Brook Electric, Inc.	1.5	No
Ross (Skagit River Complex)	Skagit River	Whatcom	Seattle City Light	338.6	Yes
Smith Creek	Smith Creek	Whatcom	Private Individual	37.8	No
Snoqualmie Falls No. 1	Snoqualmie River	King	Puget Sound Energy	11.9	No
Snoqualmie Falls No. 2	Snoqualmie River	King	Puget Sound Energy	30.1	No
South Fork Tolt River	S. Fork Tolt River	King	Seattle City Light	16.7	No
Sygitowicz Creek	Sygitowicz Creek	Whatcom	Private Individual	0.4	No
Upper Baker Dam (Baker River Complex)	Baker River	Skagit	Puget Sound Energy	90.7	No
White River	White River	Pierce	Puget Sound Energy	0	Yes
Woods Creek	E. Fork Woods Creek	Snohomish	Woods Creek, Inc.	0.7	No
Wynoochee Dam	Wynoochee River	Grays Harbor	Cities of Tacoma & Aberdeen	12.8	Yes
Yelm (Centralia Dam)	Nisqually River	Thurston	City of Centralia	13.1	No

Source: Bonneville Power Administration, May 19, 2004, Pacific Northwest Hydrosite Database (NWHS).

For dams in this analysis lacking actual cost information, fish passage capital costs were estimated by multiplying the median cost per foot by the height of the dam in feet. This approach is intended to capture costs differences among fish passage facilities due to the size of the dam. The result was assigned as a capital cost for fish passage. In the case where the dam had a listed height of zero feet, only O&M costs for fish passage were assigned. The median O&M expense assigned to dams requiring fish passage was determined by calculating the median of the annual costs obtained in interviews conducted with both hydroelectric and non-hydroelectric facility operators, and from cost data available in FERC documents.

Habitat Modification and Research and Monitoring: Average annual habitat modification and research and monitoring costs were assigned to all hydroelectric dams identified as requiring fish screens and/or fish passage and to dams that are mentioned in the Recovery Plans as representing threats to bull trout.

Dam Re-Operation: Foregone power revenues associated with bypassed water to meet potential instream flow requirements at each facility were initially considered in this analysis. However, further research and interviews revealed that cost estimation could not be accomplished for this study due to the complexity of analysis required and the site-specific nature of flow requirements and impacts on power generation.

Period of Cost Assessment

The following criteria were used to assign costs to each dam.

Estimate nominal annual costs as follows:

1. If the start year for a capital investment is known (i.e., information was available from the dam owner or other representative that could confirm the installation of specific new equipment), then the nominal capital cost is apportioned entirely to that year.[163] Nominal O&M costs would apply beginning in the same year.

2. If the start year for a capital project is unknown, it is assumed that it is equally likely for the project to take place in any future year. The capital costs are therefore evenly distributed across all future years by dividing the capital costs by the expected life of the project and apportioning this cost to each future year. O&M costs are apportioned in the same manner. Thus, annual (nominal) costs for a project with an expected life of 50 years = (capital cost/50) + (O&M cost/50), for any given year.

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163 Apportioning a nominal "lump sum" capital expenditure in a given year may appear to produce a disproportionate annual impact in that year. However, apportioning all capital costs to the start year provides the same net present value result as amortizing the capital cost over the life of the project and then taking the net present value of this stream of costs.

Estimate present value of annual costs as follows:

1. Calculate the present value of nominal costs per dam ($2004) for each year and then sum over all 50 years to get total present value per dam (e.g., present value of total prospective costs assuming a project life of 50 years, using both a seven and three percent discount rate).

2. Annualize this total present value over the life of the project using only a seven percent discount rate, assuming annual payment periods.

3. Sum, respectively, the total present value and annualized values across dams to estimate the total impact of fish-related conservation activities on hydroelectric dams.

Geographic Cost Apportionment

Except for the four hydroelectric projects which have more than one dam, all other hydroelectric projects in this study had one dam each. In the cases where there was one dam per project, costs were assessed on a per-dam basis, and the dam's costs were assigned to the fifth-field HUC in which each dam is located. At the Cushman Project, each of the two dams are located within the same HUC, so costs determined from interviews for the entire project were assigned to this HUC. In the case of the Skagit River project with three dams, the Ross Dam is within one HUC, and the Gorge Lake and Diablo dams are located in another HUC. Therefore, costs determined from interviews for this project were divided evenly among the dams, and then assigned to each dam's corresponding HUC. The two dams in the Baker River Project are within the same HUC, so average per-dam costs assigned to each dam were attributed to the same HUC. Similarly, the two dams in the Snoqualmie Falls Project are within the same HUC. However, based on other criteria in this section, no costs were assigned to this project.

Activities Related to Hydroelectric Dams

Seattle City Light has just completed a five-year "Early ESA Action Agenda" in the Skagit River Watershed totaling $5 million.[164] This effort included setting funding aside for research, feasibility studies, habitat restoration for Chinook salmon and bull trout, and acquisition of habitat in the Skagit Watershed. It is possible that some of the results of this effort may impact the operations of Ross, Gorge Lake, and Diablo dams. To account for this, a third of the $5 million cost for the Action Agenda was assigned to each of the dams for 2000, and treated as a capital cost. These amounts are then adjusted to 2004 dollars with the GDP Implicit Price Deflator.

Estimated Costs

Costs Estimated From Interviews

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[164] Personal communication with Dave Pflug, Fisheries Scientist, Seattle City Light, June 2 and 4, 2004.

Attempts were made to interview owners of 19 of the hydroelectric facilities to obtain information on past and future capital and annual costs associated with bull trout conservation measures. Complete interviews were successfully conducted with owners of ten of the facilities, and one owner gave limited information. At the Baker River, Snoqualmie Falls, and Electron dams, the process preceding relicensing is currently underway, and no estimates of future costs were available due to uncertainty surrounding recommended conservation activities. These five dams were assigned average costs based on the methods described above.

Three dams have been decommissioned or are scheduled for decommissioning in the near future. The Elwha Restoration Project, a combined effort of the USBR and the NPS, plans to remove the Elwha River and Glines Canyon dams. Removal efforts have been underway for several decades prior to listing of the bull trout.[165] The White River Hydroelectric Plant was shut down in 2004. The White River Project was decommissioned in part due to the costs associated with complying with a 1997 FERC license that included water quality requirements and activities to protect endangered fish.[166] However, personal communications and company information indicated that the plant was not economically feasible due to age of the facility and high maintenance costs.[167] Thus, costs are not assigned to these three dams for bull trout-related conservation measures.

Estimated costs were available from interviews for eight dams located in five distinct hydroelectric projects. These include Cushman Dams (Tacoma Power), Skagit River Dams (Seattle City Light), Cedar Falls Dam and Newhalem Creek Dam (Seattle City Light), and the Wynoochee Dam (Tacoma Power). Table 17 lists the costs provided by the interviews for the dams in these projects, and when the costs were first incurred. Also listed in this table and discussed below are the average costs assigned to dams for which interviews were not completed.

At the Cedar Falls Dam, all operational costs associated with improvements to habitat are performed as part of the Seattle Public Utilities' HCP, which is discussed in Section 3.5.6.2 of this report.[168] No costs were assigned to the dam in this section. At the Newhalem Creek Dam, the only conservation activities involve bypass flows that were agreed to in 1997, prior to the bull trout listing, and were primarily

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165 Personal communications with Rick Parker, Elwha Restoration Project, Bureau of Reclamation, Port Angeles, Washington, June 2, 2004; and Brian Winter, Elwha Restoration Project, National Park Service, Port Angeles, Washington, June 8, 2004. Elwha Project Human Effects Team, February 1995, *Elwha River Restoration Project: Economic Analysis, Final Technical Report.*

166 Tucker, Rob, 2000, "It's lights out for White River hydroelectric plant," Foundation for Water and Energy Education, http://www.fwee.org/news/getStory?story=1198, accessed May 13, 2004.

167 Personal communication with Roger Thompson, Puget Sound Energy, May 26, 2004. Puget Sound Energy, September 27, 1999, "White River Q&A," http://www.savelaketapps.com/puget_sound_energy.htm, accessed April 28, 2004.

168 Personal communication with Liz Ablo, Senior Environmental Analyst, Seattle City Light, February 4, 2005.

intended to benefit Chinook salmon.[169] Reliable information regarding lost revenue due to the bypass flows was not available at the time of this analysis, so no costs could be assigned to this dam.[170]

The Skagit River hydroelectric project has an ongoing research and monitoring program initially started for salmon, but which also benefits bull trout. The annual cost of this program is about $200,000.[171] The U.S. Army Corps of Engineers, the former owners of the Wynoochee Dam, are proactively installing a new fish screen there to benefit bull trout.[172]

At the Cushman Project, relicensing requirements are under litigation, although the facility is still operating. The litigation is partially due to costs associated with project modifications to protect salmon species listed under the Act required under the 1998 FERC relicensing order and the 1999 Order on Rehearing.[173] Such modifications are also likely to assist in bull trout recovery. The Service and NOAA Fisheries have recently issued Biological Opinions with "no jeopardy" findings, indicating that the current FERC order is acceptable in terms of protecting endangered salmon species. Thus, it is assumed that compliance with the current FERC relicensing order will begin to occur in the year 2006. It is also assumed that the costs estimated in the 1996 FERC Final Environmental Impact Statement will apply to the operational and facility modifications associated with listings under the Act, including bull trout.[174]

Average Costs

Table 16 provides the average costs assigned to the hydroelectric facilities for which interviews were not completed. The costs were obtained from interviews with dam owner representatives and estimates from published literature. The table divides costs among capital and annual costs. Capital costs are assigned to a single year in the analysis (or distributed uniformly when the specific start year is unknown) whereas

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[169] Personal communication with Dave Pflug, Fisheries Scientist, Seattle City Light, February 4, 2005.

[170] Seattle City Light reported that 1995 operations were changed to adjust power output to protect fish, specifically salmon and steelhead. A cost estimate of $40 million spread over 30 years was reported; however, analysis to substantiate this cost estimate was not available. Personal communication with Dave Pflug, Fisheries Scientist, Seattle City Light, March 17, 2005.

[171] Personal communication with Dave Pflug, Fisheries Scientist, Seattle City Light, June 2 and 4, 2004.

[172] Personal communication with Mike Padilla, Engineer, U.S. Army Corps of Engineers, Seattle Office, June 2, 2004.

[173] Personal communication with Pat McCarty, Tacoma Power, June 2 and 9, 2004. Federal Energy Regulatory Commission, August 1998, Project No. 460-001 and -009, Order Issuing Subsequent Major License, Dismissing Complaint as Moot, and Rejecting Motion to Intervene (Document ID 1872175); and Federal Energy Regulatory Commission, March 31, 1999, Project No. 460-011 and –014, Order on Rehearing.

[174] Personal communication with Pat McCarty, Manager, Generation Business Unit, Tacoma Power, Tacoma, Washington, June 2 and June 3, 2004; and Federal Energy Regulatory Commission, Office of Hydropower Licensing, November 1996, *Final Environmental Impact Statement, Cushman Hydroelectric Project, (FERC Project No. 460), Washington*.

annual costs occur in each year of the analysis starting with the implementation of the conservation measure (or distributed uniformly when the specific start year is unknown). Capital costs are apportioned by height of dam, while average O&M costs are applied to all dams. In general, these O&M costs represent the impact to larger hydroelectric structures and, as such, likely overstate the costs associated with O&M expenditures when applied to smaller hydroelectric facilities.

Table 17 presents the characteristics of each dam and the capital and annual costs obtained from the interviews or assigned to each dam, as well as the year in which the costs were first assigned.

Table 16
Conservation Measure Costs Applied at Hydroelectric Facilities

Conservation Measure	Capital Costs	Annual Costs[b/]
Passage Improvements, Including Trap and Haul	$20,000 [a/]	$227,000
Research and Monitoring	$0	$103,000
Habitat Enhancement Activities	$633,000	$236,000
Fish Screens Only	$85,000	$0

[a/] Costs per foot of dam height.

[b/] Annual O&M costs are based on data from large hydroelectric facilities and likely overstate costs when applied to smaller hydroelectric facilities.

Costs Related to Flow Changes

The potential economic impact of certain operational changes, such as changes to flow regimes, is not included in the cost estimates. Recommendations to augment flow or change the timing of flow through a project to facilitate fish passage can have significant economic impacts on a hydropower dam. Demand for power varies seasonally, thus the value of power changes throughout the year. To the extent that flow augmentation requires water to be passed at times of the year when it is less valuable, there may be an associated economic cost. Where fish passage through the dam is also an issue, seasonal spill over of the dam may be required to reduce the risk of fatality associated with passage through the turbines. In this case, the spilled water no longer passes through the turbines and therefore cannot be used to generate electricity. The costs of more expensive electricity may be passed on to the power consumers in the form of rate changes.

The economic impacts of flow regime changes at hydroelectric projects has been estimated in other analyses, and these costs can be substantial. A recent economic analysis of CHD by NOAA Fisheries provides examples of anticipated cost impacts associated with flow regime changes for salmon and steelhead at several hydropower projects. The estimated annual costs of changes to flow regimes range from $7 million for the Rocky Reach Dam to over $100 million at John Day Dam. These costs reflect the market value of lost power generation, and in some cases include the cost of replacement power.[175]

[175] U.S. Department of Commerce, NOAA Fisheries, November 2004, *Draft EconomicAnalysis of Critical Habitat Designation for 13 Pacific Salmon and O. mykiss ESUs,* p. D-13.

Table 17
Costs Assigned to Hydroelectric Dams

Facility Name	License Expires	Fish Screens Required	Fish Passage Required	Noted in Recovery Plan	Height (ft.)	Year Costs Begin	Capital Costs Assigned ($2004)	O&M Costs Assigned ($2004)
COSTS FROM INTERVIEWS								
Cedar Falls	Unknown	No	No	No	215	n/a	$0	$0
Cushman No. 1 (Cushman Complex)	1998	Yes	Yes	Yes	235	2006	$28,477,000	$75,000
Cushman No. 2 (Cushman Complex)	1998	Yes	Yes	Yes	225	2006	See Cushman 1	See Cushman 1
Diablo (Skagit River Complex)	2025	Unknown	Unknown	Yes	650	1998 (annual); 2000 (capital)	$1,802,000	$72,000
Elwha Dam (Elwha Restoration Proj.)	Unknown	No	No	Yes	98	n/a	$0	$0
Glines Canyon (Elwha Restoration Proj.)	1976	No	No	Yes	195	n/a	$0	$0
Gorge Lake (Skagit River Complex)	2025	Unknown	Unknown	Yes	295	1998 (annual); 2000 (capital)	$1,802,000	$72,000
Newhalem Creek	2007	Exists	Exists	No	10	n/a	$0	$0
Ross (Skagit River Complex)	2025	Exists	No	Yes	332	1998 (annual); 2000 (capital)	$1,802,000	$72,000
White River	2047	No	No	No	6	n/a	$0	$0
Wynoochee Dam	2037	No	No	No	175	1999 (annual); 2005 (capital)	$7,000,000	$33,000
AVERAGE COSTS ASSIGNED								
Baker Dam, Lower	2006	Exists	Exists	Yes	278	2006	$6,397,000	$566,000
Baker Dam, Upper	2006	Exists	Exists	Yes	278	2006	$6,397,000	$566,000
Diamond Creek	Exemption 1982	Exists	Unknown	No	0	Unknown[b/]	$633,000	$566,000
Ebey Hill	Exemption 1987	No	No	No	9	n/a	$0	$0

Table 17 (continued)
Costs Assigned to Hydroelectric Dams, (continued)

Facility Name	License Expires	Fish Screens Required	Fish Passage Required	Noted in Recovery Plan	Height (ft.)	Year Costs Begin	Capital Costs Assigned ($2004)	O&M Costs Assigned ($2004)
AVERAGE COSTS ASSIGNED (continued)								
Electron	Unknown	Unknown	Unknown	Yes	7	Unknown[b/]	$861,000	$566,000
Excelsior	Unknown	Yes	Unknown	Yes	0	Unknown[b/]	$718,000	$566,000
Falls Creek	Exemption 1982	Exists	No	No	3	n/a	$0	$0
Henry M. Jackson	2011	Unknown	Unknown	No	242	Unknown[b/]	$5,662,000	$566,000
Koma Kulshan	2037	Unknown	Unknown	No	18	Unknown[b/]	$1,086,000	$566,000
Morse Creek	2035	Exists	Exists	No	10	n/a	$0	$0
Port Townsend Mill	Exemption 1982	Exists	Exists	No	2[a\]	n/a	$0	$0
Rocky Brook	Exemption 1982	Exists	No	No	8	n/a	$0	$0
Smith Creek	Exemption 1982	Yes	Exists	No	3	Unknown[b/]	$718,000	$339,000
Snoqualmie Falls No. 1	Currently Relicensing	No	No	No	9	n/a	$0	$0
Snoqualmie Falls No. 2	Currently Relicensing	No	No	No	0	n/a	$0	$0
South Fork Tolt River[c/]	2024	Yes	Exists	No	190	Unknown[b/]	$718,000[c/]	$339,000[c/]
Sygitowicz Creek	Exemption 1982	No	No	No	4	n/a	$0	$0
Woods Creek	Exemption 1982	Exists	Unknown	No	4	Unknown[b/]	$715,000	$566,000
Yelm (Centralia Dam)	2047	Yes	Yes	No	4	Unknown[b/]	$800,000	$566,000

[a\] Estimated height.

[b/] When the year that capital and O&M costs will be incurred is unknown, this analysis apportions the total expected costs (i.e., capital and O&M) proportionally to the expected life of the project to account for uncertainty in probability of occurrence.

[c/] This analysis includes information on the costs associated with the Tolt Project. However, comment received on the draft version of this analysis indicated that these costs should not be included, as bull trout are not present at this site. Revision to this economic analysis, as described in the Author's Note (preceding the Table of Contents), acknowledges the resulting overstatement of economic impacts within the Lower Snoqualmie River HUC Watershed. Removal of the fish screen-related costs associated with the Tolt Project from the economic impacts as estimated in the draft version of this analysis would reduce the total prospective costs within the Lower Snoqualmie River HUC from $195,300 to $173,000, and the prospective costs of the entire proposed CHD from $679.3 million to $679.0 million.

Sources: Federal Energy Regulatory Commission, August 1998, Project No. 460-001 and -009, Order Issuing Subsequent Major License, Dismissing Complaint as Moot, and Rejecting Motion to Intervene, (Document ID 1872175); and Federal Energy Regulatory Commission, March 31, 1999, Project No. 460-011 and –014, Order on Rehearing. Federal Energy Regulatory Commission, Office of Hydropower Licensing, November 1996, *Final Environmental Impact Statement, Cushman Hydroelectric Project, (FERC Project No. 460), Washington*. Tucker, Rob, 2000, "It's lights out for White River hydroelectric plant," Foundation for Water and Energy Education, http://www.fwee.org/news/getStory?story=1198, accessed May 13, 2004. Puget Sound Energy, September 27, 1999, "White River Q&A," http://www.savelaketapps.com/puget_sound_energy.htm, accessed April 28, 2004. Elwha Project Human Effects Team, February 1995, *Elwha River Restoration Project: Economic Analysis, Final Technical Report*. Personal communications with: Dave Pflug, Fisheries Scientist, Seattle City Light, June 2 and 4, 2004, February 4, 2005; Mike Padilla, Engineer, U.S. Army Corps of Engineers, Seattle Office, June 2, 2004; Rick Parker, Elwha Restoration Project, Bureau of Reclamation, Port Angeles, Washington, June 2, 2004; Brian Winter, Elwha Restoration Project, National Park Service, Port Angeles, Washington, June 8, 2004; Pat McCarty, Tacoma Power, June 2 and 9, 2004; Roger Thompson, Puget Sound Energy, May 26, 2004; and Liz Ablo, Senior Environmental Analyst, Seattle City Light, February 4, 2005.

The necessity, level, and method of flow regime changes for fish conservation at a particular project are determined on a case by case basis. The economic impact associated with a flow regime change is dependent upon the type of project. For example, replacing power generated by peaking projects (i.e., projects that produce hydropower during periods of highest demand) is more expensive than replacing base power production. Without a full review of hydropower project operation, the type and level of flow changes necessary and feasible for species and habitat protection is purely speculative. The analysis required to estimate these types of economic impacts is beyond the scope of this study and therefore not included in the costs related to hydroelectric projects. As such, these costs may understate the future effects on hydroelectric dams.

Estimated Costs

Table 18 provides a summary of the potential economic costs at hydroelectric facilities. The majority of the conservation activities will be incurred in the future and are therefore assessed as prospective costs. Retrospective costs total $7.2 million, while prospective costs are $70.7 million using a seven percent discount rate. Prospective annualized costs are estimated to be approximately $5.1 million.

Table 18
Potential Economic Impacts on Hydroelectric Facilities Associated with Co-Extensive Salmon and Bull Trout Conservation Activities

Coastal-Puget Sound	Retrospective (Total)	Prospective (Total)		Prospective (Annualized)[a/]
		3%	7%	
Proposed Critical Habitat	$7,173,000	$101,938,000	$70,720,000	$5,124,000
Proposed for Exclusion	$0	$0	$0	$0
Excluded	$0	$0	$0	$0

[a/] Annualized costs are spread over 50 year life of capital projects.

3.4.2 ASSUMPTIONS AND UNCERTAINTIES

Table 19 provides a summary of assumptions and uncertainties that are associated with determining the effects on water storage projects.

Table 19
Assumptions and Uncertainties

Assumption	Direction of Bias
Because the average O&M costs used to estimate annual impacts at hydroelectric dams for which facility-specific information was not available is based on large facilities, they likely overstate annual impacts at these facilities, which tend to be smaller hydroelectric dams.	+

Assumption	Direction of Bias
Conservation activities are assigned costs in this analysis even if they would have been required under existing regulation.	+
To account for the costs of conservation activities that are for the benefit of bull trout and listed salmon species, the analysis attributes the costs of the fish-related conservation activities co-extensively to both species.	+
The height of the dam is used to assign costs associated with fish passage facilities. This assumes that the costs of fish passage are directly proportional to the height of the dam. In practice, many factors influence the costs of constructing fish passage facilities.	+/-
Potential foregone power revenues associated with bypass flows were not estimated in this analysis due to the difficulty in predicting the likelihood and costs of the conservation measure.	-
Hydroelectric dams vary widely in size, age, and purpose. Consequently, costs of conservation activities can vary greatly. The sample used to assign costs in this analysis may not reflect the actual costs at each facility	+/-
Because of uncertainty regarding the timing of future capital expenditures related to fish passage, fish screens, or habitat enhancement, this analysis apportions the costs by the expected life of the project (50 years)	+/-

+: This assumption is likely to produce an upward bias in cost estimates.

-: This assumption is likely to produce a downward bias in cost estimates.

+/-: No direction of bias can be determined.

3.4.3 Effects on Non-Hydroelectric Projects

This section addresses non-hydroelectric (non-hydro) dams. Dams and diversions associated with agricultural and road projects are addressed within other sections of this document. Development of and operational changes in Federal non-hydroelectric dams and diversions may require consultations with the Service. The Service may recommend changes in plans or operations. WDOE's Dam Safety Office regulates non-Federal non-hydro dams. This office's primary responsibilities include ensuring the structural integrity of dams to be built, as well as inspecting the operation and maintenance of existing dams.[176] The USACE may require a permit for the construction or modification of a dam under Section 404 ("Dredge and Fill") of the CWA.[177] The permit process may lead to a consultation with the Service and possibly to changes in the project in order to ensure compliance with the Act. Structural and operational changes required are likely similar to those for hydroelectric dams.

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176 Washington Department of Ecology, "Dam Safety Office," http://www.ecy.wa.gov/programs/wr/dams/dss.html, accessed June 23, 2004.

177 33 USC 1344.

3.4.3.1 Non-Hydroelectric Projects in the Coastal-Puget Sound Region

Two databases were used to identify non-hydro dams that could potentially impact bull trout critical habitat. The National Inventory of Dams database is maintained by the USACE and was used as a starting point in this analysis.[178] In addition, the WDFW maintains a database of those dams that represent barriers to fish passage.[179] These two databases contain location information that allowed the dams to be mapped using GIS software. This information was then intersected with the Coastal-Puget Sound CHD to identify the non-hydro dams that fall within the critical habitat analysis region.

All Federal non-hydro dams listed in the USACE database were included in this analysis, as consultations are likely for these facilities. From the WDFW database, a list of non-hydro dams operated by local government, public utility, State, and private owners was obtained. The list was further refined by selecting dams identified as representing barriers to bull trout. Non-hydro dams mentioned in the bull trout Recovery Plan that are located within the proposed critical habitat were compared with the resulting list from the databases. Those dams mentioned in the Recovery Plans that were not included in the database list were added. In total, 24 non-hydro dams were identified as potential barriers to bull trout within the proposed bull trout critical habitat, including six Federal dams and 18 non-Federal dams. Bull trout conservation measures were identified and implementation costs were estimated for each of the 24 dams. Table 20 lists all the non-hydroelectric dams for which costs were estimated from interviews or for which average costs were assigned. The next section discusses the data and methods used to identify the costs of bull trout conservation measures at non-hydro dams.

Cost Estimation Methods

The following procedures were used to determine the costs of bull trout conservation measures at non-hydroelectric dams and diversions:

Costs from Interviews and Other Sources

Operators of the six Federal dams described above were contacted, and cost information collected for each of these facilities. In addition, cost information was obtained for two non-Federal dams, the WDFW Dungeness Hatchery intake dam on Canyon Creek, and the Cook Creek diversion to the Quinault National Fish Hatchery. These facilities are discussed in the bull trout Recovery Plan.

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[178] U.S. Army Corps of Engineers, 1998 (last updated), "National Inventory of Dams," http://crunch.tec.army.mil/nid/webpages/nid.cfm.

[179] Washington Department of Fish and Wildlife, Science Division, Habitat Program, 2004, "WDFW Fish Passage and Diversion Screening Inventory - Dams without Fishways."

Average Costs.

There is little literature on costs incurred for conservation measures for listed fish species at non-hydroelectric dams. Therefore, average capital and O&M costs per foot of hydraulic height were calculated from the costs obtained through interviews. In general, these costs represent the impact to large dam structures and, as such, likely overstate the costs associated with capital and O&M expenditures when applied to smaller non-hydroelectric facilities. Table 21 divides costs among capital and annual costs.

Period of Cost Assessment

The following criteria were used to assign costs to each dam.

Estimate nominal annual costs as follows:

1. If the start year for a capital investment is known (i.e., information was available from the dam owner or other representative that could confirm the installation of specific new equipment), then the nominal capital cost is apportioned entirely to that year.[180] Nominal O&M costs would apply beginning in the same year.
2. If the start year for a capital project is unknown, it is assumed that it is equally likely for the project to take place in any future year. The capital costs are therefore evenly distributed across all future years by dividing the capital costs by the expected life of the project and apportioning this cost to each future year. O&M costs are apportioned in the same manner. Thus, annual (nominal) costs for a project with an expected life of 50 years = (capital cost/50) + (O&M cost/50), for any given year.

Estimate present value of annual costs as follows:

1. Calculate the present value of nominal costs per dam (2004 $) for each year and then sum over all 50 years to get total present value per dam (e.g., present value of total prospective costs assuming a project life period of 50 years, using both a seven and three percent discount rate).
2. Annualize this total present value over the life of the project using only a seven percent discount rate, assuming annual payment periods.
3. Sum, respectively, the total present value and annualized values across dams to estimate the total impact of fish-related conservation activities on non-hydroelectric dams.

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180 Apportioning a nominal "lump sum" capital expenditure in a given year may appear to produce a disproportionate annual impact in that year. However, apportioning all capital costs to the start year provides the same net present value result as amortizing the capital cost over the life of the project and then taking the net present value of this stream of costs.

Table 20
Non-Hydroelectric Dams and Diversions in the Proposed Coastal-Puget Sound Bull Trout Critical Habitat and Costs Assigned

Facility Name	Stream	Facility Owner/ Operator	Primary Purpose	Height (ft.)	Interview Completed	Year Costs Begin	Capital Costs ($2004)	O&M Costs ($2004)
COSTS FROM INTERVIEWS								
Chambers Lake Dam	Muck Creek	U.S. Army, Ft. Lewis	Other	7	Yes	n/a	$0	$0
Diversion to Quinault National Fish Hatchery [c/]	Cook Creek	Quinault Indian Nation	Water Supply	n/a	Yes	2002	$604,000	$0
Frozen Lake	Tributary--White River	NPS	Water Supply	14	Yes	n/a	$0	$0
Hiram M. Chittenden Locks & Dam	Lake Washington Ship Canal	USACE	Navigation	25	Yes	1998	$0	$2,129,000
Howard A. Hansen Dam	Green	USACE	Flood Control	220	Yes	1998	$49,961,000	$3,056,000
Mud Mountain	White River	USACE	Flood Control	350	Yes	1998	$0	$254,000
Texas Pond	Tributary—Rinker Creek	USFS	Recreation	14	Yes	n/a	$0	$0
AVERAGE COSTS ASSIGNED								
City of Bellingham Diversion Dam[c/]	Middle Fork Nooksack River	City	Water Supply	12[a/]	No	Unknown[d/]	$454,000	$200,000
Dungeness Hatchery Intake Dam[c/]	Canyon Creek	WDFW	Water Supply	15	No[b/]	Unknown[d/]	$334,000	$50,000
Headworks Diversion Dam[c/]	Middle Green River	City of Tacoma	Water Supply	5[a/]	No	Unknown[d/]	$189,000	$83,000
Masonry Dam[c/]	Cedar River	City of Seattle Public Utilities	Multiple	215	No	Unknown[d/]	$8,138,000	$3,575,000
Pipeline No. 1 (City of Tacoma)[c/]	White River	City of Tacoma	Water Supply	5[a/]	No	Unknown[d/]	$189,000	$83,000

Table 20 (continued)
Non-Hydroelectric Dams and Diversions in the Proposed Coastal-Puget Sound Bull Trout Critical Habitat and Costs Assigned

Facility Name	Stream	Facility Owner/ Operator	Primary Purpose	Height (ft.)	Interview Completed	Year Costs Begin	Capital Costs ($2004)	O&M Costs ($2004)
AVERAGE COSTS ASSIGNED (continued)								
Shoecraft Lake Outlet	Tulalip Creek	State	Recreation	8.0	No	Unknown[d/]	$303,000	$133,000
Unnamed	Shaw Creek	Private	Other	3.3	No	Unknown[d/]	$125,000	$55,000
Unnamed	Rauch Creek	Private	Fire Protection, or Stock Pond	3.9	No	Unknown[d/]	$112,000	$49,000
Unnamed	Unnamed	Private	Fire Protection, or Stock Pond	19.7	No	Unknown[d/]	$745,000	$327,000
Unnamed	Unnamed	Private	Water Supply	2.6	No	Unknown[d/]	$99,000	$44,000
Unnamed	Unnamed	Private	Water Supply	0.8	No	Unknown[d/]	$31,000	$14,000
Unnamed	Unnamed	Private	Water Supply	1.5	No	Unknown[d/]	$56,000	$25,000
Unnamed	Steven's Creek	Private	Recreation	2.6	No	Unknown[d/]	$99,000	$44,000
Unnamed	S. Fork Deer Creek	Private	Recreation	6.6	No	Unknown[d/]	$248,000	$109,000
Unnamed	S. Fork Deer Creek	Private	Recreation	4.6	No	Unknown[d/]	$174,000	$76,000
Unnamed	S. Fork Deer Creek	Private	Other	4.9	No	Unknown[d/]	$186,000	$82,000
Upper Hatchery Rack	Kendall Creek	State	Other	4.1	No	Unknown[d/]	$155,000	$68,000

[a/] Heights estimated.

[b/] Source for costs: Koehler, Steve, 2003, "Remove the Dam on Canyon Creek, Protect the Peninsula's Future," http://www.olympus.net/community/oec/cyncr.htm, accessed June 19, 2004.

[c/] Conservation measures for these dams recommended in U.S. Fish and Wildlife Service, 2004, *Draft Recovery Plan for the Coastal-Puget Sound Distinct Population Segment of Bull Trout (Salvelinus confluentus),* "Volume I (of II): Puget Sound Management Unit," and "Volume II (of II): Olympic Peninsula Management Unit," Portland, Oregon.

[d/] When the year that capital and O&M costs will be incurred is unknown, this analysis apportions the total expected costs (i.e., capital and O&M) proportionally to the expected life of the project to account for uncertainty in probability of occurrence.

Estimated Costs

Table 21 lists the average costs applied to non-hydro dams.

Table 21
Average Conservation Measure Costs Applied at Non-Hydroelectric Dams

Conservation Measure	Capital Costs	Annual Costs
Passage Improvements, Including Trap and Haul	$38,000[a/]	$14,000[a/]
Fish Screens Only	$585,000	$0

[a/] Costs per foot of dam height.

Table 22 provides a summary of the potential economic costs at non-hydroelectric facilities. Retrospective costs total $87.4 million (due in large part to capital projects on Federal dams), while prospective costs are $82.7 million using a seven percent discount rate. Prospective annualized costs are estimated to be approximately $6.0 million.

Table 22
Potential Economic Impacts on Non-Hydroelectric Facilities Associated with Co-Extensive Salmon and Bull Trout Conservation Activities

Coastal-Puget Sound	Retrospective (Total)	Prospective (Total)		Prospective (Annualized)[a/]
		3%	7%	
Proposed Critical Habitat	$87,401,000	$154,244,000	$82,732,000	$5,995,000
Proposed for Exclusion	$0	$0	$0	$0
Excluded	$0	$0	$0	$0

[a/] Annualized costs are spread over 50 year life of capital projects.

3.4.4 ASSUMPTIONS AND UNCERTAINTIES

Table 23
Assumptions and Uncertainties

Assumption	Direction of Bias
Only non-hydroelectric dams indicated by WDFW and the Service as barriers to bull trout migration were assigned costs. All other dams were excluded from the analysis. However, it is not possible to predict if all of the included dams will bear costs due to section 7 or section 9.	+/-
To account for the costs of conservation activities that are for the benefit of bull trout and listed salmon species, the analysis attributes the costs of the fish-related conservation activities co-extensively to both species.	+

Assumption	Direction of Bias
The height of the dam is used to assign costs associated with fish passage facilities.	+/-
Non-hydroelectric dams vary widely in size and purpose. Consequently, costs of conservation activities can vary greatly. The relatively small sample used to assign costs in this analysis may not reflect the actual costs at each facility	+/-
Because of uncertainty regarding the timing of future capital expenditures related to fish passage or fish screens, this analysis apportions the costs by the expected life of the project (50 years)	+/-

+: This assumption is likely to produce an upward bias in cost estimates.

-: This assumption is likely to produce a downward bias in cost estimates.

+/-: No direction of bias can be determined.

3.5 EFFECTS ON FOREST MANAGEMENT PRACTICES AND TIMBER HARVESTING

Private, State, and Federal timber land managers are required through various regulations to implement bull trout conservation activities. For example, owners of private timber lands in Washington are required to modify activities as a result of the Washington Forest Practices Act, first passed in 1946 (Map 11). The current Forest Practices Act, passed in 1974, has been amended and strengthened various times for environmental reasons, including in response to the listings of various threatened and endangered species.[181] The Act was amended following the listing of the marbled murrelet in 1993, the Northern spotted owl in 1994, and the listing of various anadromous fish species, including steelhead, chum salmon, and bull trout in 1998 and 1999. In 1999, scientists and Federal officials became concerned about the impact of timber harvest and forest road development and maintenance on listed fish species, which led to a drafting of the Forest and Fish Report, a foundation for the forestry module portion of the Washington salmon recovery plan. In 2001, based on the recommendations of the Forest and Fish Report, the latest version of the Washington State Forest Practice Rules took effect.[182] The revisions identified various conservation activities – implemented through the State DNR permit required to harvest timber – designed to protect habitat for listed species including spotted owl, salmon, and bull trout. This

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[181] A summary of rule changes can be found at: www.dnr.gov/forest practices/rules/history3-17-4.pdf, visited June 17, 2004.

[182] In practice, however, forest land managers anticipated the implementation of the 2001 provisions for the protection of listed fish species and were already following fish conservation measures as early as 1999 (personal communication with Service Biologist, Western Washington Fish and Wildlife Office, Lacey, Washington, June 17, 2004).

report focuses on the provisions related to fish species conservation including riparian buffer zones, road decommissioning, road repair, and improved engineering of forest roads and stream crossings.[183]

Other bull trout conservation activities on private timber land are implemented through an HCP agreement with the Service (see Section 3.2.2.2 above and Map 12 in the Map Attachment). In order to avoid violation of the "take" provision of the Act, some large timber land owners – including private landowners and the State – enter into HCP agreements, which explicitly identify conservation activities to protect listed species.[184] As described above under Section 3.2.2.2, HCPs impose an economic cost on HCP landowners during the development and implementation phase.[185] This section considers the economic impact of HCP conservation activities on private land.

Timber management activities that occur on Federal land (e.g., USFS lands) must comply with bull trout conservation activities through the section 7 consultation process with the Service.[186] Economic effects associated with these activities accrue to the USFS and/or third parties. As previously noted, these activities flow in part from the NWFP as well as other Federal and State regulations, but are all driven by a common goal: the protection of listed fish species, including bull trout.[187] This analysis considers economic effects from these activities to be relevant. As discussed above, the full cost of these fish-related conservation measures are attributable to bull trout.

The activities and associated economic impact of fish-related conservation activities related to forest management on private, State and Federal forest lands are discussed below. For an overview map of timber lands in the affected area, see Map 11 in the Map Attachment to this report.

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183 As noted in Section 1.5, private forest lands governed by the Forest and Fish Report regulations are proposed for exclusion from critical habitat. Therefore, this study identifies these cost estimates separate from other forest-related costs within the proposed critical habitat lands.

184 HCPs can cover a variety of activities. However, the HCPs covering bull trout in the affected area generally cover forest management (timber harvest and road maintenance). In addition to forest management activities, two HCPs – the City of Tacoma and the City of Seattle (Cedar River) – also cover water supply and hydroelectric power supply.

185 Section 3.2.2.2 illustrates the range of costs associated with developing a multi-species habitat conservation plans, but does not attempt to quantify its impact attributable to bull trout. However, this section discusses the economic impact associated with implementing fish conservation strategies arising from the HCP agreements.

186 Federal timber lands also apply to BLM lands. Because there is less than 1,000 acres of BLM land in the proposed bull trout designation, this analysis focuses on USFS lands.

187 The NWFP defines Standards and Guidelines (S&Gs) for forest use throughout the 24 million acres of Federal lands in its planning area. Among other things, the S&Gs provide for the protection of fish species during the following activities on USFS and BLM lands: management of timber, roads, grazing, recreation, minerals, fire/fuels management, fish and wildlife management, general land management, riparian area management, watershed and habitat restoration, and research activities. In addition, PACFISH, a strategy for restoring and protecting habitat for anadromous fisheries in watersheds in Federal ownership in the west, have developed guidelines that are almost identical to those in the NWFP.

3.5.1 Fish-Related Conservation Activities

Timber harvest and associated forest management activities affect bull trout habitat in a number of ways. Clear cutting in riparian areas may prevent large woody debris from reaching streams and can increase water temperatures from reduced shading. Timber harvest, road building, road maintenance, and other ground-disturbing activities can increase sedimentation in streams.[188] In order to minimize the impact of these activities on fish species, the Service and other regulatory agencies have identified a number of conservation activities deemed protective of listed fish species. Inevitably, these activities also provide other co-extensive environmental benefits (e.g., improved water quality or preservation/conservation of land). The specific activities vary depending on project details, but generally include the following:

- Improve routine road maintenance practices;
- Identify and remove or abandon unstable, unused, or problem roads;
- Minimize stream crossings when building roads and implement specific engineering requirements where stream crossings are necessary;
- Eliminate fish barriers (e.g., culverts);
- Implement riparian management zones around streams where timber harvest is restricted or limited. Riparian zones may also include additional wind buffers where appropriate;
- Conduct ecological thinning and selective timber harvest to promote healthier forest ecosystems; and
- Implement a monitoring program to assess the impact of fish-related conservation activities.

3.5.2 Cost Estimation Methodology

Economic effects associated with forest management activities are estimated for different ownership categories. The number and type of forest activities likely to occur are identified and per unit costs are developed for relevant conservation activities. A recent economic study estimating the opportunity costs of foregone timber sales resulting from compliance with Washington's Forest Practice Rules provides the

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188 U.S. Fish and Wildlife Service, 2004, *Draft Recovery Plan for the Coastal-Puget Sound Distinct Population Segment of Bull Trout (Salvelinus confluentus),* "Volume I (of II): Puget Sound Management Unit," Portland, Oregon.

basis for some cost estimates.[189] Table 24 summarizes this approach. Additional detail on the approach for estimating economic impact for each landowner type is provided below.

Table 24
Summary of Approach for Estimating Potential Economic Impact on Timber Lands

Timber Land Owner	Forest Activities Affecting Bull Trout	Method for Estimating Economic Impact
Federal Land (USFS)	Federal actions including timber harvest, road repair, road decommissioning, restoration, etc.	Cost of various conservation activities identified in section 7 consultations and through the NWFP
Private and State HCP Lands	Timber harvest, road repair/decommissioning, water supply	Cost of various conservation activities identified through the Washington Forest Practice Rules; opportunity costs of foregone timber sales; costs of road maintenance/stream crossings; set-up costs; and projected HCP cost commitment schedule
Private Non-HCP Lands	Timber harvest, road repair/decommissioning	Cost of various conservation activities identified through the Washington Forest Practice Rules; opportunity costs of foregone timber sales; costs of road maintenance/stream crossings; and set-up costs

3.5.3 DATA SOURCES

A number of data sources were used to develop cost estimates associated with forest management:

- GIS land ownership and land cover information obtained from the Interior Columbia Basin Ecosystem Management Project (ICBEMP) and the Washington State GAP analysis project.

- Schedule of Proposed Actions (SOPA) documents for USFS National Forest units specifying expected future activities.

- GIS data for HCP land ownership from the Service.

- Personal communication with HCP managers, Service personnel, and other stakeholders.

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189 Perez-Garcia, Jane Edelson, and Kevin Zobrist, January 22, 2001, *Small Business Economic Impact Statement for New Proposed Forest Practices Rules Implementing the Forests and Fish Report*, DNR Agreement #FY00-133.

- NEPA planning documents associated with HCPs, including incidental take permit statements and associated environmental impact statements.

- Previous economic analyses related to Washington's Forest Practice Rules, including a study conducted by Perez-Garcia, et al., in 2001.

- Various sources of cost information including personal communication with affected parties, project proposals for Bonneville Power Administration's Fish and Wildlife Grants Program and the Wyden Amendment Watershed Restoration program, as well as transportation costs from the State of Washington.

3.5.4 EFFECTS ON USFS LAND MANAGEMENT

Activities conducted by the USFS are wide-ranging, but include fuel reduction, road construction, road removal and road maintenance, maintenance of recreation facilities, fisheries programs, timber sales, and permitting of various use permits. Past and future direct costs of compliance per watershed were estimated for six categories of conservation activities associated with these activities (see Table 27).[190] This analysis includes approximately 1.4 million acres of Federal land in the prospective analysis and 1.6 million acres in the retrospective analysis.

Conservation activities for anadromous fish species are identified in three primary protection efforts: the NWFP, PACFISH, and various biological opinions resulting from past section 7 consultations with the USFS. Both the NWFP and PACFISH were initiated in 1994 (prior to the bull trout listing of 1998); however, the costs associated with implementing conservation activities arising from these initiatives are considered relevant to the economic effects associated with bull trout conservation and therefore are included in this analysis. The following steps summarize the methodology for estimating economic effects attributable to Federal land management activities:

1. Estimate the number of acres of USFS land per watershed. Table 25 provides a summary of total acres within each national forest. Table 25 includes *only* the acreage within HUC watersheds that contain a designated stream reach. It excludes acres of wilderness, where costs associated with

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190 Comments received from the Alliance for the Wild Rockies and the Friends of the Wild Swan noted that the estimated costs contained in the DEA associated with forestry impacts on USFS land do not consider the benefits of reduced timber harvest sales on Federal lands. Specifically, the commenter asserted that "below cost" timber sales on Federal land result in a burden on American taxpayers and therefore, reduced timber harvest on Federal lands as a result of bull trout conservation efforts would lead to a reduced burden on American taxpayers. The Final EA acknowledges that net social welfare impacts are likely as a result of reduced timber harvest on Federal lands. Further, it is relevant to consider net cost impacts, where possible, in determining the benefit of exclusion. However, this analysis does not consider the costs associated with reduced timber harvests on Federal lands in Coastal-Puget Sound because those measures are part of the Northwest Forest Plan (1991) and pre-date the listing of the bull trout (1998). Instead, the analysis examines the impact of increased costs associated with timber harvests on Federal land as a way to capture the efficiency effects of altered timber harvest practices.

USFS land management is less likely. Table 26 includes the acreage of all WRIA watersheds (i.e., inclusive of all HUCs, not just proposed critical habitat), but excludes acres of wilderness.

Table 25
Federal USFS Land within the HUCs Containing Proposed Critical Habitat for Bull Trout

National Forest Unit	Acres[a/]	Share of Total CHD[b/] (%)
Mt. Baker-Snoqualmie National Forest	929,000	9.6%
Olympic National Forest	483,000	5.0%
Okanogan National Forest	85,000	0.9%
Gifford Pinchot National Forest[c/]	3,000	<0.1%
Total	1,500,000	15.5%

[a/] Total number of acres in HUCs containing proposed critical habitat, based on a rounded GIS calculation of HUCs with designated stream reaches and including all USFS land except wilderness.

[b/] Total acres in HUCs containing proposed CHD is approximately 9,666,622 acres.

[c/] Gifford Pinchot National Forest does not contain proposed critical habitat stream reaches, but non-wilderness lands within the National Forest are within the boundaries for the prospective economic analysis (i.e., HUC watershed supporting proposed critical habitat).

Table 26
Federal USFS Land within the Coastal-Puget Sound Population Region, Retrospective Analysis

National Forest Unit	Acres[a/]	Share of Total CHD[b/] (%)
Mt. Baker-Snoqualmie National Forest	982,000	8.4%
Olympic National Forest	536,000	4.6%
Okanogan National Forest	85,000	0.7%
Gifford Pinchot National Forest	50,000	0.4%
Total	1,653,000	14.2%

[a/] Total number of acres based on a rounded GIS calculation of WRIAs with designated stream reaches and including all types of USFS land, except wilderness lands.

[b/] Total acres in the WRIA watersheds within the proposed CHD is approximately 11,631,488 acres.

2. Identify the types and quantity of activities likely to occur at the four national forests within the proposed CHD using annual Schedule of Proposed Action (SOPA) reports. It is assumed these activities are fairly constant and likely to continue each year into the future, based on a discussion

with forest managers.[191] These activities include fuel reduction activities, road maintenance, road obliteration, fisheries programs, and permitting of various use permits.

3. Identify conservation activities commonly associated with these major Federal land activities.[192]

4. Estimate annual unit price of conservation activities, including a range of costs based on a variety of project types. Specifically, cost information is based on more than 20 approved project proposals for Bonneville Power Administration's Fish and Wildlife Grants Program and the Wyden Amendment Watershed Restoration program as well as transportation costs from the State of Washington. Table 27 summarizes costs of Federal actions and associated conservation activities, and presents a range of costs associated with each category.

5. Estimate the total annual cost of conservation activities per National Forest by multiplying the per project conservation cost for each conservation activity described in Table 27 by the expected annual number of Federal actions projected in each Forest's SOPA.

6. Identify total size of each of the four National Forests through GIS analysis (e.g., acres).

7. Develop a per acre cost of conservation activities based on the total area and total annual conservation activities costs at each forest. Based on the analysis of four national forests, the per acre cost is approximately $5.24 per acre.

8. Estimate total acres of watershed for both the prospective and retrospective CHD.

9. Multiply annual per acre cost of conservation activities on Federal land by the number of acres of Federal land per watershed for both the prospective and retrospective analysis (Table 28).

10. For the prospective analysis, adjust for the portion of economic effects unlikely to occur in "nearshore marine habitat HUCs."

Based on the per acre cost of conservation activities on Federal lands, bull trout estimated economic effects are anticipated to be $7.0 million annually (see Table 29). Total prospective costs are $50.4 million applying a seven percent discount rate.

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[191] Carol Brown, Sawtooth National Forest, March 10, 2004, suggested that projects listed in quarterly SOPAs are likely to continue indefinitely at the present annual rate.

[192] This report does not consider the economic impacts of a no-cut riparian zone associated with bull trout conservation on Federal lands because this measure was originally initiated through the Northwest Forest Plan and implemented prior to the 1998 listing of the bull trout (personal communication with Chris Hansen-Murray, Forester, Mt. Baker-Snoqualmie National Forest, July 25, 2004).

Table 27
Summary of Conservation Activities and Costs for Activities on Federal Land

Activities	Typical Conservation Activity (Per Project)	Costs
Road maintenance, aquatic habitat projects, instream work, riparian	Develop an approved spill containment plan. Conduct erosion control activities. Minimize vegetation disturbance. Follow guidelines for replacement stream crossing design. Revegetate stream-side area. Gather/obtain materials needed to complete the project and implement bank stabilization. Minimize brushing in riparian areas by leaving a minimum 10 feet buffer along intermittent and ephemeral streams, and a minimum 20 feet buffer along perennial streams.	\$48,100 to \$211,500
Fisheries, wildlife, botany, and cultural programs	Minimize disturbance to fish by training personnel in survey method. Coordinate with other local agencies to prevent redundant surveys.	\$4,200 to \$5,400
Road decommissioning, removal, storm-proofing, and inactivation	Develop an approved spill containment plan. Maximize activities during late summer and early fall during dry conditions. A biologist should participate in the design and implementation of the project. Dispose of waste on stable site. Nearby is acceptable if approved by a geotechnical engineer or other qualified personnel.	\$8,400 to \$16,600
Telephone line and power line renewal	Directionally fell hazard trees toward streams and riparian areas where it is safe and feasible to do so. Conduct erosion control activities. Minimize soil disturbance using filter materials such as straw bales or silt fencing. Rehabilitate and stabilize all disturbed areas by seeding and planting.	\$4,300 to \$22,500
Special use permits	Prior to issuance of a special use permit, a fisheries biologist shall make a written evaluation of the proposed action and any interrelated and interdependent effects of the action to determine if an individual consultation is necessary. Conduct erosion control activities. Minimize soil disturbance using filter materials such as straw bales or silt fencing. Rehabilitate and stabilize all disturbed areas by seeding and planting.	\$1,200 to \$2,400
Fuel reduction, timber salvage (non-commercial), logging, thinning	Minimize take from construction activities by ensuring that an effective spill prevention, containment and control plan is developed, implemented and maintained. Minimize take from vegetation management including salvage harvest and commercial thinning by minimizing adverse effects of key components of steelhead habitat. Complete annual comprehensive monitoring report.	\$40,300 to \$115,500

[a/] Based on the number and type of activities occurring at four National Forest Units in the bull trout affected area.

Source: Bonneville Power Administration's Fish and Wildlife Grants Program and the Wyden Amendment Watershed Restoration program, WDOT.

Table 28
Estimation of Economic Effects on Federal Lands

	Total Acres	Annual Per Acre Cost	Number of Years for Analysis	Total Annual Cost Projects	Total Costs Attributable to Bull Trout
Federal Land Activities – Prospective (Annual)	1,500,000	$5.24	1	$7,850,000	$6,953,000[a/]
Federal Land Activities-Retrospective (1998 - 2004)	1,653,000	$5.24	5	$43,270,000	$50,448,000

[a/] Total Costs Attributable to Bull Trout accounts for the removal of costs associated with "nearshore marine habitat HUCS."

Table 29
Summary of Economic Effects on Federal Lands

Coastal-Puget Sound	Retrospective (Total)	Prospective (Total)		Prospective (Annualized)
		3%	7%	
Proposed Critical Habitat	$50,448,000	$103,448,000	$73,664,000	$6,953,000
Proposed for Exclusion	$0	$0	$0	$0
Excluded	$0	$0	$0	$0

3.5.5 EFFECTS ON PRIVATE NON-HCP LANDS

There are approximately 2.3 million acres of private forest lands not covered by an HCP in the bull trout CHD, representing approximately 24 percent of the CHD.[193] These lands are subject to management under the Washington Forest Practices Rules.[194] The Washington Forest Practice Rules were implemented primarily following recommendations in the Forest and Fish Report of 1999. As noted in Section 3.5.2, these include a curtailment of harvests in the Riparian Management Zone (RMZ) near streams, and additional road maintenance, stream crossing, and harvesting set-up costs incurred.

3.5.5.1 Economic Effects Associated with Reduced Timber Harvest

The economic effects associated with restrictions on private timber lands within the proposed bull trout CHD (e.g., HCP and non-HCP lands) include direct effects (e.g., reductions in profit to timber land

193 Determined from GIS analysis.

194 As noted in Section 3.2.2.2, certain lands (e.g., Department of Defense, HCP, etc.) are excluded from the designation of critical habitat, including lands already covered through the Washington Forest Practice Rules. These exclusions do not impact this economic analysis, which estimates the impacts of conservation measures to protect bull trout.

owners) and secondary or indirect impacts (e.g., effects on harvesters, processors, logging companies, mills, etc.). This analysis uses Total Asset Value to represent the direct effect to timber land owners. To highlight secondary impacts to the regional economy, the analysis considers the results of similar economic studies as well as the IMPLAN input/output model.

Total Asset Value

This analysis relies on measures of the "total asset value" derived from Perez-Garcia, et al., to reflect the efficiency loss associated with conservation activities on timber lands. Total asset value as defined in the Perez-Garcia, et al., study represents the value of land and standing timber. For the purpose of this analysis, reduction in asset value is assumed to represent the efficiency loss as a result of conservation activities including both reduced revenue to landowners from foregone timber sales and/or increased operating costs for harvesters associated with road building or maintenance requirements.

The analysis assumes total asset value is equivalent to a bid price from a timber purchaser that reflects the future discounted producer rents expected from the standing timber. Inevitably, total asset value will reflect changes in harvest costs, timber prices, and interest rates. For example, if harvest costs decline as a result of technological advances, the increase in the future stream of rent from the timber stand will encourage a higher bid. Similarly, a reduction in the volume of harvestable timber due to restrictions of land area that may be cut will reduce the asset value of the stand. Therefore, asset value will rise or fall with changing harvest technologies and market timber prices.[195] To the extent that harvest in riparian areas is restricted due to bull trout conservation activities, the efficiency loss is represented by a reduced total asset value.

3.5.5.2 Estimating Economic Effects

The following steps were taken to estimate the economic effects associated with timber activities on private non-HCP lands:

1. Identify the number of acres of non-Federal, non-HCP forested lands per watershed within the proposed CHD through GIS analysis. Primary land use was used to identify parcels with the following attributes: hardwood forest, mixed hardwood/conifer forest, and conifer forest.

2. Estimate a per acre annual cost of compliance for three cost categories identified in the Perez-Garcia, et al., study. To develop per acre annual costs, the following adjustments are made (Table 30).

[195] Interest rate changes are more likely to affect the timing of harvest and therefore unlikely to result in efficiency changes.

Table 30
Development of Per Acre Costs Associated with Small and Large Non-HCP Timber Land Owners

Cost Category	Total Cost \$2003[a/]	Total Cost Per Acre[b/]	Total Annual Cost Per Acre[c/]	Total Annual Cost Per Acre - 20 Year Adjustment[d/]	Final Adjusted Per Acre Cost (2004)[e/]
RMZ Foregone Sales					
Large Timberowner[f/]	\$11,462,665	\$427	\$9.63	\$6.92	\$7.88
Small Timberowner	\$6,201,436	\$569	\$12.84	\$9.23	
Road Maintenance and Stream Crossings					
Large Timberowner	\$7,145,007	\$266	\$6.31	\$4.54	\$3.33
Small Timberowner	\$1,802,232	\$95	\$2.25	\$1.62	
Set-up Cost					
Large Timberowner	\$516,002	\$19	\$0.46	\$0.33	\$0.31
Small Timberowner	\$311,529	\$16	\$0.39	\$0.28	
Total					
Large Timberowner				\$11.79	\$11.52
Small Timberowner				\$11.13	

[a/] Total asset value derived from Perez-Garcia, et al., study and represents the total costs associated with the forest practice rules on the GIS-sampled forest lands. Costs are assumed to represent the impact of bull trout conservation activities. Dollars inflated to 2004 using GDP deflator.

[b/] In the GIS sample, there were 26,860 acres of large timber land owners and 19,040 acres of small timber land owners.

[c/] To annualize the total asset value, this analysis relies on the study's 50 year rotation for riparian management zone foregone sales and, for road maintenance and stream crossings and set-up costs, this analysis uses a weighted average of the acres of both pole timber (30 year rotation) and reproduction areas/non-pole timber (50 years). The weighted average is based on the quantity of each timber type found in sample size (47.2).

[d/] The Perez-Garcia, et al., study examines all potentially affected forest lands over a typical 50 year timber cycle, considering all future income (or loss in value) derived from that land over 50 years. To adjust for the 20 year time frame of this analysis, examine only the loss in value to lands that would have been harvested in the next 20 years. Since approximately 72 percent of the impact in annual value terms occurs in the first 20 years of the 50 year investment, this analysis includes only that portion of the annual value.

[e/] Accounts for weighted average of the ratio of small to large timber owners found in the GIS sample.

[f/] Large timber land owners include operations with 50 employees or more; small owners are all other operations.

3. The portion of total asset value impacted by each of the three cost categories is divided by the number of acres in the study's GIS sample of private forest land for both large and small timber owners. The Perez-Garcia, et al., study provides different cost estimates for both small and large land owners.[196]

4. To develop an annualized value (in year 2004 dollars), assume a 5.8 percent discount rate as used in the Perez-Garcia, et al., study and a weighted average of the acres of both pole timber (30 year rotation) and reproduction areas/non-pole timber (50 years). The weighted average is based on the quantity of each timber type found in the GIS sample size (47.2 years).

5. The Perez-Garcia, et al., study examines all potentially affected forest lands over a typical 50 year timber cycle, considering all future income (or loss in value) derived from that land over 50 years. To adjust for the 20 year time frame of this analysis, examine only the loss in value to lands that would have been harvested in the next 20 years. That is, young and/or immature tree stands that exist today and may be harvested in 20 years or more hence may be impacted by a reduced timber harvest volume but that loss in value is not attributable to bull trout given the 20 year time frame over which CHD impacts will occur. Since approximately 72 percent of the impact in annual value terms occurs in the first 20 years of the 50 year investment, this analysis includes only that portion of the annual value.

6. To develop a generalized per acre cost, utilize a weighted average of the ratio of small to large timber owners found in the GIS sample.

7. Finally, the State of Washington created programs to mitigate timber land adverse economic impacts to small business associated with various forest conservation activities. For example, the riparian easement program would pay an estimated $0.68 for every dollar of lost sale attributable to applicable regulation for small business owners that harvest less than two million board feet per year. These and other mitigation programs for small landowners represent transfer payments from taxpayers to the regulated community, and are not efficiency losses and are not included in the total.

8. To estimate the total annual impact, multiply the annualized per acre cost by the total acres of non-HCP timber lands per watershed in the bull trout CHD.

9. To estimate total prospective costs for these activities, calculate the total present value of annual costs over the 20-year period of the analysis, using three and seven percent discount rates.

[196] Large timber land owners include operations with 50 employees or more; small owners include all other operations. In the GIS sample, there were 26,860 acres of large timber land owners and 19,040 acres of small timber land owners.

10. For the prospective analysis, adjust economic impacts occurring in "nearshore marine habitat HUCs" to reflect the fact that inland timber activities are unlikely to incur costs associated with the proposed designation. For the retrospective analysis, multiply annual costs by 6.5 years, the time since the bull trout was listed. Total retrospective costs are based on costs incurred since bull trout was listed in 1998.

Table 31
Calculation of Economic Costs Associated with Non-HCP Private Timber Lands

Cost Category	Per Acre Annual Cost (2004)	Total Acres	Total Annual Cost
Riparian Management Zone Foregone Sales	$7.88	2,306,000	$18,177,000
Road Maintenance and Stream Crossings	$3.33		$7,670,000
Set-Up Cost	$0.31		$709,000
Total	$11.52		$26,556,000
Impacts Associated with Co-Extensive Salmon and Bull Trout Conservation Activities[a/]			$20,145,000

[a/] Total costs account for the removal of costs associated with "nearshore marine habitat HUCs."

3.5.5.3 Summary Results: Potential Effects on Private Non-HCP Lands

Total potential economic effects associated with timber harvesting on private non-HCP lands is approximately $20.1 million annually.

Table 32
Summary of Potential Economic Costs Associated with Non-HCP Private Timber Lands

Coastal-Puget Sound	Retrospective (Total)	Prospective (Total)[a/]		Prospective (Annualized)
		3%	7%	
Proposed Critical Habitat	$0	$0	$0	$0
Proposed for Exclusion	$236,775,000	$299,710,000	$213,419,000	$20,145,000
Excluded	$0	$0	$0	$0

[a/] Because annual values generated by the Perez-Garcia study utilize a 5.8 percent discount rate, the total prospective impacts attributable co-extensively to salmon and bull trout over the 20-year period of the analysis do not represent an estimate using entirely a three and seven percent discount rate, as is the case with other activities.

3.5.6 EFFECTS ON HCP LANDS

As discussed in Section 3.2.2.2, there are six existing HCPs in the bull trout CHD. Four of the existing HCPs cover land that is entirely contained within watersheds containing proposed designated stream reaches that support bull trout: Washington Department of Natural Resources (DNR), City of Seattle, City of Tacoma, and Simpson Timber Company. The other two existing HCPs –Plum Creek and West Fork – generally include land within the same watersheds as stream reaches proposed for designation, but include some unoccupied stream reaches as well. For example, the City of Tacoma owns HCP-covered lands within the upper Green River watershed that includes incidental take coverage for bull trout. Similarly, Plum Creek HCP includes permit coverage for incidental take for bull trout (Plum Creek is currently amending their permit to add bull trout) and own lands in the upper portions of watersheds that contain occupied reaches that are proposed bull trout critical habitat. Land use activities covered by all six HCPs have the potential to impact downriver bull trout habitat and, as such, include specific fish-related conservation activities designed to mitigate this impact. Therefore, this analysis includes the economic effects associated with implementing fish-related, HCP conservation activities across all six HCPs.[197]

This analysis focuses on the costs of HCP implementation associated with the protection of bull trout populations. Inevitably, the conservation activities associated with implementing these HCPs generate habitat benefits for various species, including salmon species. Where possible, the analysis excludes the costs of conservation activities designed specifically for salmon populations or other species and only includes costs of activities in areas where bull trout are located. For example, the Cedar River HCP provides for specific conservation activities (e.g., instream flows) to benefit Chinook and steelhead populations found below Chester Morse Reservoir. The economic costs of these activities are not assessed. Instead, the analysis focuses on the cost of road repair and reconstruction and other erosion control measures implemented above the reservoir where populations of bull trout are known to migrate and spawn.[198] Similarly, the analysis focuses on costs associated with implementing City of Tacoma HCP conservation activities related to road reconstruction, fish passage/culvert analysis, and biological surveys related to bull trout and does not estimate the economic impact of instream flow alterations for steelhead and Chinook. In some cases, however, conservation activities provide protection for salmon and bull trout concurrently. In these cases, the analysis attributes all costs to salmon.

As noted under Section 3.2.2.2 above, the addition of bull trout to the list of species covered by an incidental take permit under an HCP agreement generates only minor administrative costs, but no incremental costs associated with implementation because the existing conservation activities called for under the original HCP are generally deemed protective of fish species that may become listed in the future. The focus of this analysis, however, is the economic cost of conservation activities that improve the likelihood of recovery of the bull trout population. Therefore, this analysis considers the economic effects of all relevant fish-related conservation activities on HCP lands within the bull trout proposed critical habitat.

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[197] As noted previously, four of these six HCPs are excluded from critical habitat and the effects of these lands are presented separately.

[198] Where per acre costs of road repair and reconstruction are applied, the analysis relies on the acreage of the upper Cedar River watersheds, which is known to support bull trout.

To estimate HCP implementation costs across 1.6 million acres of state and private land (17 percent of the affected area), this analysis divides the six HCPs into three categories – private timber companies, city utilities, and State lands (e.g., DNR). Table 33 below summarizes the approach.

Table 33
Summary of Approach for Estimating Economic Costs Associated with HCP Lands

HCP Cost Category	HCP Agreements	Primary Land Management Activities	Cost Estimation Methodology and Primary Sources
Private Timber Lands	Plum Creek; Simpson; West Fork	Private timber harvest; road maintenance	• Per unit estimates of foregone timber sales and road maintenance for large timber land owners (Perez-Garcia, et al., study) • Individual HCP planning documents
City Utility Lands	City of Seattle (Cedar River); City of Tacoma	Water supply; limited timber harvest; road maintenance	• Actual/projected expenditures for City of Seattle • Personal communication with HCP managers
State Lands	Washington State DNR	Timber harvest; road maintenance	• Per unit estimates of foregone timber sales and road maintenance (weighted average of large and small timber land owners) (Perez-Garcia, et al., study) • Individual HCP planning documents

3.5.6.1 Cost Estimation Methodology – Private HCP Timber Lands

The economic effects associated with HCP implementation on private timber lands are estimated as follows:

1. Estimate the number of acres of HCP land per watershed. Table 34 summarizes total acres of all HCP lands in the designation.[199] As described in Section 1.2, fifth-field HUC watersheds are the basis for the geographic boundaries of the analysis.

2. For private HCP timberlands, estimate the per acre annual cost of compliance for three cost categories identified in the Perez-Garcia, et al., study for large timber land owners (i.e., RMZ foregone sales, road maintenance and stream crossings, and set-up costs). Development of per acre annual costs is summarized in Table 35. The GIS sample used in the Perez-Garcia, et al., study generally excluded HCP lands; however, for the purpose of this analysis, it is assumed the cost of activities identified in the Washington State Forest Practice Rules (the subject of the

[199] GIS coverage of HCP lands provided by Service GIS Analyst, Western Washington Fish and Wildlife Office, Lacey, Washington, May 20, 2004.

Perez-Garcia, et al., study) represent a rough approximation of the economic effects associated with conservation activities commonly followed by HCP landowners.

Table 34
HCP Lands within the Bull Trout CHD

HCP Name	Acres[a/]	Percent of Total Affected Area[b/]
Excluded Lands		
Washington DNR	1,218,200	10.5%
City of Tacoma Public Utilities	14,600	0.1%
Simpson	254,400	2.2%
City of Seattle (Cedar River Watershed)	89,900	0.8%
Proposed CHD		
West Fork	11,600	0.1%
Plum Creek	53,400	0.5%
Total	**1,642,100**	**14.1%**

a/ Reflects total acres of HCP land found in watersheds containing bull trout habitat. For the purpose of cost calculations on a per acre basis, a subset of affected acres may be used (see below).

b/ A total of approximately 11,631,000 acres of land within HUC watersheds are affected by the proposed CHD.

Table 35
Per Acre Annual Cost for Private HCP Timber Lands[a/]

Cost Category	Final Per Acre Annual Costs (2004)[b/]
Riparian Management Zone (RMZ) Foregone Sales	$ 6.92
Road Maintenance and Stream Crossings	$ 4.54
Set-up Cost	$ 0.33
Total	$ 11.79

a/ Per acre cost is based on Perez-Garcia, et al., for large timber landowners in Western Washington.

b/ Annual per acre costs are developed in Table 30.

3. To estimate the total annual impact in 2004 dollars, multiply the per acre annual cost by the total acres of HCP lands per watershed in the bull trout CHD (Table 36).

Table 36
Calculation of Annual Costs Associated with Private HCP Timber Lands

Private HCP	Total Acres of HCP Land	Per Acre Annual Costs (2004$) [a/]	Total Annual Costs[b/]
Simpson Timber (Green Diamond)	254,400	$11.79	$2,999,000
Plum Creek Timber I-90	53,400		$630,000
West Fork Timber (Murray Pacific)	11,600		$137,000
Total	**319,400**		**$3,766,000**

[a/] Per acre annual costs are based on Perez-Garcia et al., study for large timber land owners.

[b] Adjustments are not made for "nearshore marine habitat HUCs" because all costs are incurred prior to proposed CHD.

4. To apportion the total annual costs and total retrospective by watershed (i.e., HUC), divide the total annual impact by the number of acres covered by the HCP agreement, and apportion to each watershed according to the number of HCP acres found in the watershed.

5. To estimate total retrospective costs for each HCP agreement, multiply the total annual costs by the number of years since the agreement was signed.

6. Prospective costs are assumed to be zero since all HCP costs were initiated as a result of the listing of the species, and are not attributable to the proposed critical habitat.

Table 37
Summary of Total Economic Costs Associated with Private HCP Timber Lands

HCP	Year HCP Completed[b/]	Impacts Co-Extensive with Salmon and Bull Trout[a/]			
		Retrospective Total ($2004)	Prospective Total		Prospective (Annualized)
			(3%)	(7%)	
Simpson Timber (Green Diamond)	2000	$11,999,000	$44,632,000	$31,782,000	$3,000,000
Plum Creek Timber I-90	2004	$0	$9,372,000	$6,674,000	$630,000
West Fork Timber (Murray Pacific)	2001	$411,000	$2,038,000	$1,451,000	$137,000
Total[c]		**$12,411,000**	**$52,043,448**	**$39,907,000**	**$3,766,000**

[a/] Prospective adjustments are not made for "nearshore marine habitat HUCs" because all costs are incurred prior to proposed CHD.

[b/] HCPs for Plum Creek and West Fork completed in 1996 and 1995, respectively, but did not include bull trout conservation activities. Amendments were added in 2004 and 2001, respectively, to include incidental take coverage for bull trout.

[c/] Totals may not add due to rounding.

3.5.6.2 Cost Estimation Methodology – City Utility Lands

To estimate the economic effects associated with HCP implementation on utility lands, this analysis identifies expenditures for bull trout related conservation activities as part of the City of Seattle's HCP cost commitment schedule[200] Seattle developed a unique HCP agreement with the Service that structured HCP compliance around annual expenditures for conservation activities for various listed species. Where data are not available on specific expenditures by the City of Tacoma, this analysis applies per unit costs derived from the City of Seattle's actual and expected HCP expenditures to Tacoma's HCP. The following discussion describes the development of these costs for the City of Seattle (Upper Cedar River Watershed) and the City of Tacoma (Upper Green River Watershed).

<u>City of Seattle Cost Development</u>

1. Identify HCP Utility lands in order to quantify the number of acres affected by bull trout conservation activities.[201]

2. Identify fish-related conservation activities from both the Seattle and Tacoma HCP agreements. Since land management objectives are similar for both HCPs (i.e., provide water supply, decommission forestry roads, etc.), fish-related conservation activities are also similar.[202] For example, riparian restoration, road abandonment, road repair, and bull trout monitoring costs are included. Other HCP conservation activities associated with spotted owl, minimum instream flow for salmon, and sockeye-related fish passage are excluded. Where possible, this analysis quantifies the number of conservation activities expected (e.g., miles of road to be decommissioned).

3. For Seattle, summarize annual costs associated with each category of fish-related conservation activities based on the total present value of projected expenditures over the 50 year period of Seattle's HCP agreement. Specific cost figures are provided by the City of Seattle.[203] Annual

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[200] Cost data based on personal communication with Cyndy Holtz, HCP Program Manager, Seattle Public Utilities, June 16, 2004.

[201] GIS coverage of HCP lands provided by Service GIS Analyst, Western Washington Fish and Wildlife Office, Lacey, Washington, May 20, 2004.

[202] Seattle's HCP does not call for any additional timber harvest, while limited timber harvest is allowed to continue under Tacoma's HCP. However, the amount of timber harvest on Tacoma's land is minimal. For example, they are allowed to harvest up to 136 acres per year, but rarely harvest that amount (personal communication with Paul Hickey, HCP Manager, City of Tacoma, June 1, 2004). Therefore, this analysis does not consider costs associated with modifying timber harvest activities.

[203] Data from personal communication with Cyndy Holtz, HCP Program Manager, Seattle Public Utilities, June 23 and June 29, 2004.

figures are developed by applying three and seven percent discount rates (see Table 38). The costs identified in the HCP are generally based on bull trout-specific conservation activities and does not overlap with salmon conservation activities.

Table 38
Summary of City of Seattle Annual HCP Implementation Costs[a/]

Fish-Related Conservation Measure	Annual Costs[b/]
Watershed Restoration	$375,000
Ecological Thinning/Restoration	$333,000
Ballard Locks Improvements	$155,000
Watershed Road Repair	$617,000
Bull Trout Monitoring/Studies	$107,000
Road Decommissioning	$426,000
Total Annual Costs	**$2,010,000**

[a/] Costs based on personal communication with Cyndy Holtz, HCP Program Manager, Seattle Public Utilities, July 2004. These costs reflect only fish-related conservation activities and are not representative of the full cost of implementing Seattle's HCP agreement.

[b/] Totals may not add due to rounding.

4. For Tacoma, summarize annual costs associated with various fish-related conservation activities called for under the City's HCP, including road sedimentation plan, and fish barrier removal.[204] Due to a lack of available data, road repair and road decommissioning costs for the City of Tacoma are estimated based on the number of miles of road expected to undergo repair/decommissioning and the associated costs from Seattle's HCP (see Table 39). The costs identified in the HCP are generally based on bull trout-specific conservation activities and does not overlap with salmon conservation activities.

5. To apportion the total annual costs for both Seattle and Tacoma HCPs by watershed (i.e., HUC), divide the total annual impact by the number of acres covered by the HCP agreement, and apportion to each watershed according to the number of acres of HCP land found in the watershed.

6. To estimate total retrospective costs for each HCP agreement, multiply the total annual costs by the number of years since the agreement was completed.

[204] HCP Implementation Costs from personal communication with Paul Hickey, HCP Manager, City of Tacoma, June 15, 2004.

Table 39
Summary of City of Tacoma Annual HCP Implementation Costs[a]

Category	Annual Costs[b]
Road Sediment Reduction Plan, Fish Barrier Removal, and Other Miscellaneous HCP Implementation Costs	$88,000
Road Decommissioning and Repair[c]	$93,000
Total	$181,000

[a] Effects associated with reduced timber harvest are not included because decisions related to reducing annual timber harvest date back to 1992 and predate any concerns related to bull trout.

[b] Totals may not add due to rounding.

[c] Road costs are based on 63 miles of core road miles expected to be repaired and 43 miles of road decommissioning, assumed to occur over the next 20 years. Per mile costs for road decommissioning assumed to be approximately $37,000; per mile costs for road repair assumed to be approximately $4,300.

Table 40
Summary of Total Estimated Costs Associated with City Utility HCP Lands

HCP	Year HCP Completed	Retrospective Total ($2004)	Prospective Total (3%)	Prospective Total (7%)	Prospective (Annualized)
Cedar River (City of Seattle)	2000	$8,040,000	$29,903,000	$21,293,000	$2,010,000
Tacoma Public Utilities	2001	$543,000	$2,692,000	$1,917,000	$181,000
Total		**$8,583,000**	**$732,596,000**	**$23,211,000**	**$2,191,000**

3.5.6.3 Cost Estimation Methodology – State DNR Lands

The following steps were taken to estimate the economic effects associated with HCP implementation on Washington State DNR lands:

1. Identify DNR lands covered by the HCP agreement through GIS analysis.[205]

2. Identify fish-related conservation activities identified as part of the DNR HCP. These include road repair and decommissioning as well as riparian management zone restrictions. This analysis excludes other non-fish related activities agreed to as part of the HCP.

3. Estimate costs associated with road repair and decommissioning by identifying the number and type of road projects likely to occur on DNR lands annually. Information specific to the DNR

[205] GIS coverage of HCP lands provided by Service GIS Analyst, Western Washington Fish and Wildlife Office, Lacey, Washington, May 20, 2004.

HCP indicates that each year approximately 30 to 60 miles of roads are likely to be abandoned or repaired.[206] In this analysis it is assumed 30 miles will be abandoned and 30 miles will be repaired each year.

4. The per mile cost of road abandonment and repair are based on past expenditures by the City of Seattle under its HCP. To estimate the annual costs associated with these road projects on DNR land, multiply per mile cost of road abandonment and repair by the annual number of miles associated with each type of road project (see Table 41).

Table 41
Summary of Potential Economic Impacts on DNR HCP Lands Associated with Co-Extensive Salmon and Bull Trout Conservation Activities

Fish-Related Conservation Measure	Per Unit Cost	No. of Units	Unit	Total Annual Costs
Road Removal/Abandonment	$36,844	30	road mile	$1,105,00
Road Upgrade/Repair	$4,290	30	road mile	$129,000
Foregone Timber Sales (Riparian Management Zone)[a/]	$6.92	1,218,000	acres forested land	$8,433,000
Total Annual Costs of Co-extensive Conservation Activities				$9,667,000

[a/] Foregone timber sales estimate is based on Perez-Garcia, et al., study and includes only the cost of foregone timber sales from riparian zones for large timber companies.

5. To estimate per acre cost of riparian management zones timber restrictions, this analysis relies on the Perez-Garcia, et al., study for large timber owners. To estimate the costs associated with foregone timber sales, multiply per acre annual cost associated with riparian management zone restrictions by the total acres of DNR land in the bull trout CHD (see Table 35). Because the no-cut buffer zones established in the DNR HCP are generally more stringent than those assessed in the Perez-Garcia, et al., study, these estimates may understate economic effects.

6. To apportion the total annual costs for the DNR HCP by watershed (i.e., HUC), divide the total annual impact by the number of acres covered by the HCP agreement, and apportion to each watershed according to the number of acres of HCP land found in the watershed.

7. To estimate total retrospective costs, multiply the total annual costs by the number of years since the agreement was completed.

8. For total retrospective costs, assume impacts are distributed evenly across HCP land within each watershed and apportion total retrospective costs on a per acre basis to each watershed.

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[206] Information on road miles collected from Washington DNR Habitat Conservation Plan.

Table 42
Summary of Total Estimated Impacts on DNR HCP Timber Lands Associated with Co-Extensive Salmon and Bull Trout Conservation Activities

HCP	Year HCP Completed	Impacts Co-Extensive with Salmon and Bull Trout[a/]			
		Retrospective (Total) ($2004)	Prospective Costs		Prospective (Annualized)
			(3%)	(7%)	
Washington DNR	1998[b/]	$48,350,000	$143,865,000	$102,444,000	$9,670,000

[a/] Prospective adjustments are not made for "nearshore marine habitat HUCs" because all costs are incurred prior to proposed CHD.

[b/] HCP officially completed in 1997 and included fish-related conservation measures due in part to proposed listing of bull trout and other listed species. For the purpose of this analysis, costs are counted from 1998 onward.

3.5.6.4 Summary Results: Potential Effects on HCP Lands

The aggregated economic effects associated with private, utility, and State timber lands are provided below in Table 43. The summary table below also presents acres of HCP land, which is used to apportion total HCP implementation costs to each watershed, assuming each acre of HCP land is equally likely to incur one of the implementation costs discussed above. Prospective costs are assumed to be zero since all HCP costs were initiated as a result of the listing of the species, and are not attributable to the proposed critical habitat.

Table 43 provides a summary of the potential economic costs for HCPs. Retrospective costs total $69.3 million, while prospective costs are $165.6 million using a seven percent discount rate. Prospective annualized costs are estimated to be approximately $15.6 million.

Table 43
Summary of Potential Economic Impacts on HCP Lands Associated with Co-Extensive Salmon and Bull Trout Conservation Activities

HCP	Acres of HCP Land	Year HCP Signed	Impacts Co-Extensive with Salmon and Bull Trout[a/]			
			Retrospective (Total)	Prospective (Total)[b/]		Prospective (Annualized)
				(3%)	(7%)	
Washington DNR	1,218,243	1999	$48,349,995	$143,865,182	$102,444,118	$9,670,000
Tacoma Public Utilities	14,647	2001	$543,000	$2,692,823	$1,917,517	$181,000
Simpson Timber (Green Diamond)	254,424	2000	$11,999,990	$44,632,425	$31,782,043	$3,000,000
Plum Creek Timber I-90	53,435	2004	$0	$9,372,809	$6,674,229	$630,000
West Fork Timber (Murray Pacific)	11,600	2001	$411,450	$2,038,214	$1,451,380	$137,000
Cedar River (City of Seattle)	89,935	2000	$8,040,000	$29,903,724	$21,293,969	$2,010,000
Total Impact – Proposed CHD	**65,035,**	-	**$411,450**	**$11,411,000**	**$8125,000**	**$767,000**
Total Impact – Excluded Lands	**1,577,249**		**$68,932,000**	**$221,094,000**	**$157,437,000**	**$14,861,000**

[a/] Seattle and Tacoma impacts are bull trout-specific and therefore not affected by overlapping salmon habitat.

[b/] Timeframe for the retrospective costs varies.

3.5.7 SUMMARY OF EFFECTS RELATED TO FOREST MANAGEMENT PRACTICES AND TIMBER HARVESTING

Total potential economic effects associated with forest management practices and timber harvesting– including Federal land (e.g., USFS), private HCP land, and non-HCP private land – is approximately $7.7 million annually within critical habitat, $20.1 million in lands proposed for exclusion, and $14.9 million for lands excluded from critical habitat (retrospective costs). Table 44 provides a summary of the estimated effects.

Table 44
Summary of Potential Economic Impacts on Forest Management Practices and Timber Harvesting Associated with Co-Extensive Salmon and Bull Trout Conservation Activities

Category	Retrospective (Total)	Prospective (Total)		Prospective (Annualized)
		3%	7%	
USFS Lands	$50,488,000	$103,448,000	$73,664,000	$6,953,000
Utility HCP Land	$8,583,000	$32,596,547	$23,211,485	$2,191,000
Private HCP Lands	$12,411,439	$56,043,448	$39,907,652	$3,767,000
DNR HCP Lands	$48,349,995	$143,865,182	$102,444,118	$9,670,000
Private Non-HCP Forested Lands	$236,775,288	$299,710,170	$213,418,866	$20,145,231
Proposed for Critical Habitat[a/]	**$50,859,450**	**$114,859,023**	**$81,789,609**	**$7,720,000**
Proposed for Exclusion	**$236,775,288**	**$299,710,170**	**$213,418,866**	**$20,145,231**
Excluded	**$68,932,984**	**$221,094,154**	**$157,437,646**	**$14,861,000**

[a/] Annual costs for lands proposed for critical habitat include USFS lands ($6,953,000) and HCP lands not explicitly excluded in the Federal Register ($767,000). Specifically, the Federal Register excluded lands associated with four HCPs that contain proposed designated stream reaches for bull trout. Two other HCPs, Plum Creek and West Fork Timber companies, were not specifically excluded and cover timber management activities on a small portion of land in HUC watersheds containing designated stream reaches. These lands are considered "proposed for critical habitat" for the purpose of this analysis.

3.5.8 Key Assumptions Related to Forest Management Practices and Timber Harvesting

Table 45 provides a list of assumptions and uncertainties that apply to the analyses of forest management practices for the three categories of forest land considered: Federal lands, lands covered by an HCP, and private lands not covered by an HCP.

Table 45
Assumptions and Uncertainties

Assumption	Direction of Bias
Federal Land	
All fish-related conservation activities implemented since 1998 that are most commonly associated with section 7 consultations for bull trout, the NWFP, and/or PACFISH are included. Habitat conservation activities related to upland species are not included in this analysis (e.g., spotted owl example).	+

Assumption	Direction of Bias
It is assumed that the total number of timber sales is unlikely to change significantly due to bull trout conservation activities. Consequently, economic effects are focused on those associated with specific mitigation activities implemented during a typical Federal timber sale. Therefore, this portion of the analysis does not include the opportunity costs of foregone timber sales.	-
Based on the per acre approach, watersheds with more acres of USFS land will receive a higher cost impact relative to other watersheds. The analysis only includes HUC watersheds that contain a designated stream reach.	+/-
Costs are apportioned to each watershed assuming each acre of Federal land is equally likely to incur costs associated with conservation activities.	
Regional economic impacts resulting from conservation activities on USFS land are not considered.	-
To account for the costs of conservation activities that are for the benefit of bull trout and listed salmon species, the analysis attributes the costs of the fish-related conservation activities co-extensively to both species.	+
HCP Lands	
Because this analysis focuses on the costs of implementing conservation activities associated with HCPs and does not include the cost of developing HCPs (which are too difficult to quantify based on the multi-species approach), it likely understates the total economic effects of HCPs (see also 3.2.2.2).	
This analysis does not estimate the economic impact of implementing two ongoing HCPs – King County Wastewater Treatment and the Washington State Forest Practice Rules – based on the lack of information on specific conservation activities to be included in the future incidental take permit and the exact size and scope of the final agreement.	
For DNR HCP, this analysis assumes the no-cut buffer zones are generally equivalent to those assessed in the Perez-Garcia, et al., study. To the extent the DNR buffer zones are more stringent, these estimates may understate economic effects.	-
The analysis assumes the effects to private timber companies of complying with conservation activities results in an overall negative effect on the company's net revenue, though this may not necessarily be the case. For example, HCP agreements can provide access to trade organizations that promote forestry practices that are substantially similar to those required under the HCP agreements.[207] These organizations, and an accompanying "green" labeling	++

[207] Specifically, West Fork, Plum Creek and Simpson Timber companies are members in the Sustainable Forestry Initiative, which is a prerequisite for joining the American Paper and Forest Association trade organization.

Assumption	Direction of Bias
program, may result in access to a wider consumer market, potentially offsetting the cost of HCP development.[208] To the extent private timber companies obtain a competitive advantage, this analysis likely overstates the costs of HCP implementation.	
To account for the costs of conservation activities that are for the benefit of bull trout and listed salmon species, the analysis attributes the costs of the fish-related conservation activities co-extensively to both species.	+
The analysis assumes the typical HCP conservation activities in the Simpson and Plum Creek agreements closely resemble those within the Washington Forest Practice Rules, the subject of the Perez-Garcia, et al., Study. For HCP Lands, this analysis uses only the costs incurred by large timber land owners.	+/-
The analysis distributes total annual HCP costs throughout the designation on a per acre basis and assumes each acre has an equally likely chance of incurring these costs.	
Private Non-HCP Lands	
The analysis assumes the typical conservation activities on private non-HCP timber lands closely resemble those within the Washington Forest Practice Rules, the subject of the Perez-Garcia, et al., study.	
Costs are apportioned to each watershed assuming each acre of private non-HCP land is equally likely to incur costs associated with conservation activities.	
Costs of historic compliance are attributed as co-extensive among salmon and bull trout.	

+: This assumption is likely to produce an upward bias in cost estimates.

-: This assumption is likely to produce a downward bias in cost estimates.

+/-: No direction of bias can be determined.

3.5.9 Regional Economic Impacts

Regional economic impact analysis can be used to determine the potential distributional effects of conservation activities, as discussed in Section 1.1.2. By using an input-output (I-O) model for the local

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[208] Private timber companies may receive other economic benefits of membership, including possible public recognition of their environmental stewardship through a labeling program for their sustainably-managed timber products. A recent study at Oregon State University study (Anderson and Hansen, 2002) generally concluded that Ecolabels attract favorable attention from consumers, though consumers are not always willing to pay a premium for the product, depending on market characteristics. Nonetheless, the study pointed to economic benefits associated with increasing market share through a labeling program if pricing matched market conditions. Therefore, while this analysis highlights the costs associated with adhering to certain conservation measures, it is possible that implementation of these forest practices identified in an HCP provides a company with economic benefits that may or may not balance the upfront costs.

economy, it is possible to quantify the additional changes in the regional economy that result from an initial change, such as reduced timber harvests. It is important to note that these regional economic impacts are distributional effects, which are fundamentally different measures of economic costs than efficiency effects, and cannot be added to or compared with the other economic cost estimates (efficiency effects) presented in this report.

An I-O model is one of the most commonly used tools for quantifying regional economic changes, as it can be used to measure the flow of commodities and services among the industries and institutions, such as households, present within a region. Because businesses within a local economy are linked together through the purchase and sales patterns of goods and services produced in the local area, an action that has a <u>direct</u> impact on one or more local industries is likely to have an <u>indirect</u> impact on many other businesses in the region. A decline in timber harvests, for instance, leads to a decline in purchases of required inputs, such as machinery or support services. These additional effects are known as the indirect economic impacts. Reductions in earnings by laborers lead to additional regional impacts through the reduction in the purchases of household goods and services. The additional impacts generated by reduced household spending are known as <u>induced</u> economic impacts.

A key element of an I-O model is the measurement of the direct, indirect, and induced linkages within a regional economy. The tool most often used to measure these interrelationships is known as a multiplier. A variety of multipliers are generated by an input-output model and each is associated with a specific industry. A multiplier is a single number which quantifies the total economic effects (for all businesses) which arise from direct changes in the economic activity of a single industry. Multipliers can be generated to measure the total output, income, and employment effects associated with changes in the demand for regional goods and services. For example, an output multiplier of 2.5 for a specific industry would indicate that a $100,000 decline in sales by this industry would lead to an overall decline of $250,000 in business sales throughout the economy, including the initial $100,000 loss. An employment multiplier of 2.0 for an industry would indicate that a loss of ten jobs in this sector would lead to an additional loss of ten jobs in other industries for a total loss of 20 jobs throughout the regional economy.

IMPLAN (“IMpact analysis for PLANning”), a system of software and data used to perform economic impact analysis, was used to develop an I-O model for the 12-county region encompassing proposed critical habitat for the Coastal-Puget Sound population. Originally developed by the USDA Forest Service, the IMPLAN system is now maintained and marketed by the Minnesota IMPLAN Group, Inc. (MIG). The data are developed by MIG annually, using data collected at the national, state, and county level for all possible elements from a variety of State and Federal sources. The model used in this analysis is based on 2001 data, the most recently available at the time of this study. The 12 Washington counties included in the I-O model and as discussed previously in the socioeconomic profile (Section 3.1), are: Clallam, Grays Harbor, Island, Jefferson, King, Mason, Pacific, Pierce, Skagit, Snohomish, Thurston, and Whatcom counties.

3.5.9.1 Forward and Backward Linkages

The multipliers generated by the I-O model only trace backward linkages, or linkages between an industry and its suppliers, or between households and producers of household goods and services. For example, backward linkages for the logging industry would include the purchases of labor, fuel, equipment, and other inputs used to produce the logging industry's product, raw logs.

Forward linkages, however, are not captured through the I-O model multipliers. A forward linkage exists between an industry producing a good or service and the purchasers of that good or service. The purchaser might be another industry that will use the good in the production of a product, or a household purchasing the good or service for their own consumption. For the logging industry, an example of a forward linkage would be the sawmill industry. Sawmills purchase logs, a product of the logging industry, to which sawmills add value by producing lumber. The logging industry multiplier, however, would not capture this forward linkage.

In order to determine the total regional economic impacts that might result from reductions in timber harvest, it is necessary to consider how to capture both backward and forward linkages outside of the I-O model. This is discussed in the next section.

3.5.9.2 Regional Economic Impacts of Reduced Timber Harvests

Previous sections discuss the economic effects associated with reduced timber harvests and increased timber harvest costs within the bull trout Coastal-Puget Sound critical habitat area, including private non-HCP (FFR lands proposed for exclusion), private HCP (primarily includes HCP lands which have been excluded from proposed critical habitat), and DNR timber lands (lands excluded from proposed critical habitat). For this discussion of regional economic impacts, only the reduction in timber harvest associated with riparian management zones (RMZs) is considered, in aggregate form. Increased harvest costs are not relevant to the regional impact analysis as they represent a shift in distribution of costs throughout the chain of economic events in processing timber into wood products, not an actual loss to the regional economy. That is, while the timber harvest operation may incur additional road maintenance or set-up costs when viewed at the regional level, this may be offset by the benefit to other industries, either within or outside the region, providing the additional materials or services needed. For this analysis, it is assumed that the costs for road maintenance and set-up are for purchases within the region, so this is not included in the impact analysis.

Table 46 presents annual asset value attributable to co-extensive salmon and bull trout conservation activities in total and for the RMZ only for each of the timber land types, as determined above. The RMZ portion of the total asset value represents annual foregone timber sales. These figures include only the portion of asset value related to revenue loss associated with reduced timber harvest, and excludes increased road maintenance or set-up costs. Previous sections for each of the timber land types describe the derivation of these numbers.

Table 46
RMZ Portion of Total Annual Asset Value Associated with Co-Extensive Salmon and Bull Trout Conservation Activities (Foregone Timber Sales Revenue)

Economic Analysis Impact Category	Total Annual Asset Value	RMZ Portion of Total Annual Asset Value
Private Non-HCP Forestry (FFR Lands, Proposed for Exclusion)	$20,145,000	$13,789,000
Private HCP Forestry (Primarily Excluded Lands)	$3,767,000	$2,212,000
DNR Forestry (Excluded Lands)	$9,670,000	$8,436,000
Total	**$33,582,000**	**$24,436,000**

Note: Numbers may not sum due to rounding.

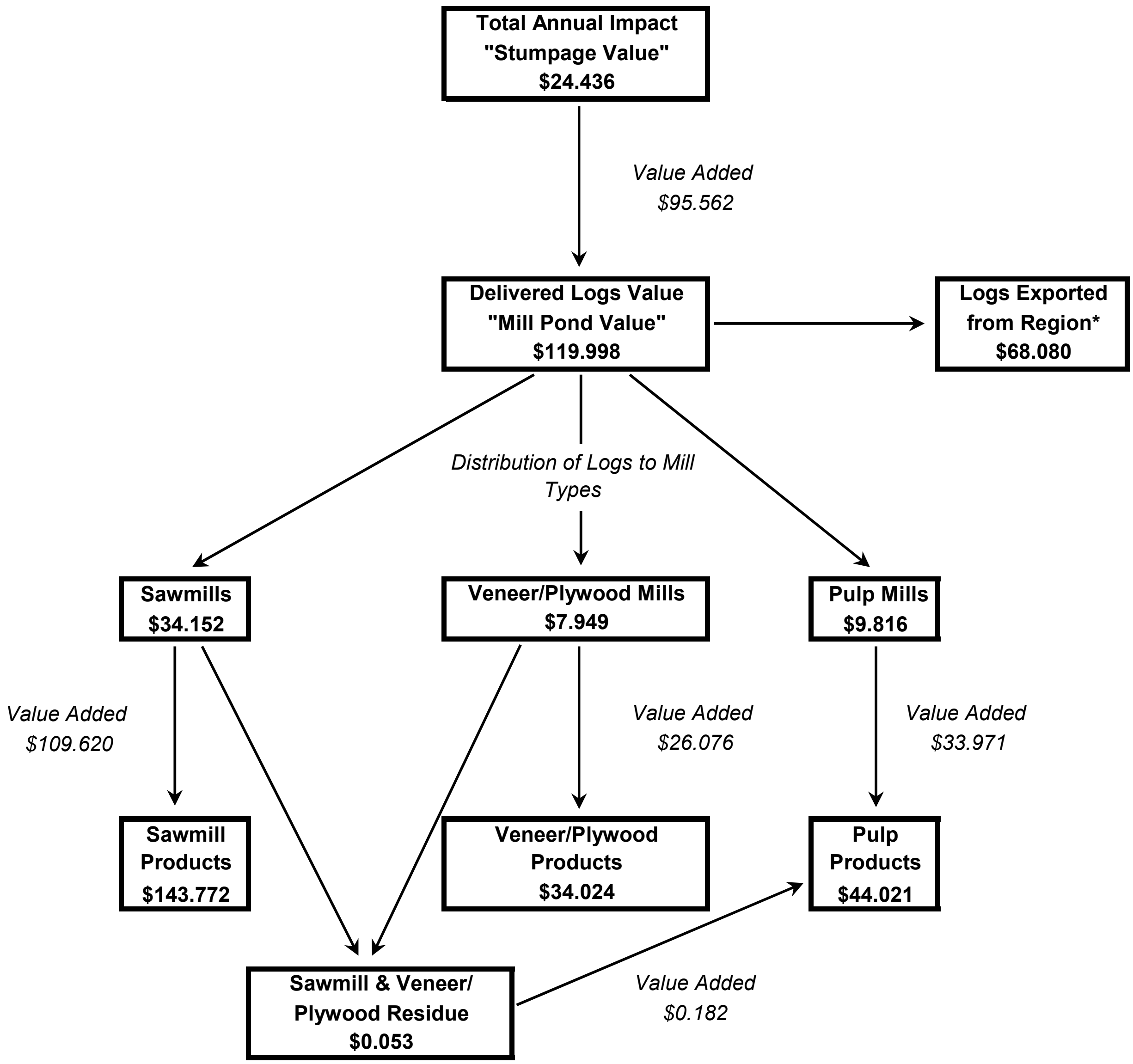
The foregone timber sales (e.g., the RMZ portion of total annual asset value) can also be considered as "stumpage value," or the value of standing timber prior to logging or milling. Once the timber is harvested, additional value is added through the logging and transport process, as logs are delivered to mills. The value of the logs delivered to mills is known as the "mill pond value," and is equal to the stumpage value plus the value added through logging, which incorporates all inputs into the logging process, including labor.

Further processing occurs after the logs arrive at the mills, resulting in a variety of wood products, such as sawn lumber, plywood, or pulp. More value is added to the logs through this process, resulting in wood products that are much more highly valued than the original standing timber.

In order to capture the forward linkages of the lost timber harvests and describe the full extent of the regional economic impacts, it is necessary to trace the flow of harvested timber through the primary wood-using industries. The value of those wood products that could have been produced from the lost timber harvest represents the direct economic impact to the region. Entering this direct impact into the I-O model provides an estimate of the indirect and induced impacts on the regional economy. This measurement of impacts more fully accounts for all of the forward and backward linkages of the lost timber harvest.

The flow from reduced timber harvest value (stumpage value) through the value-adding industries to a final value of wood products is shown in Figure 1. Information from the IMPLAN database is used to determine the value added by logging, converting stumpage value to "mill pond value" for the total lost timber harvest. According to the IMPLAN database, the commodity produced by the industry "forest nurseries, forest products, and timber tracts" accounts for approximately 20 percent of the inputs (based on dollar value) to the logging industry. The RMZ portion of the total asset value ($24.4 million) is the value of this raw commodity, and the other inputs used by the logging industry represent value-added to the raw commodity. This information is used to calculate the dollar value of the logging output based on the given quantity of input. If $24.4 million in stumpage value makes up about 20 percent of the logging output, then dividing $24.4 million by 20 percent gives the total value of the logging output, including both the initial $24.4 million stumpage value input and value-added by the logging industry. The estimate of this final value of logs, which is also called the "mill pond value," is about $120.0 million.

Figure 1
Reduced Timber Harvest Values Flow to Final Value of Wood Products ($millions)



* "Exports" includes both domestic and foreign trade, or logs that leave the Coastal-Puget Sound region.

IMPLAN commodity balance sheets provide information on the disposition of commodity production to the industries and institutions purchasing the commodities. The commodity balance sheet for the logging industry in the Coastal-Puget Sound model shows the allocation of logs to local milling sectors and exports.[209] According to the IMPLAN database, slightly less than 57 percent of logs are exported from the Coastal-Puget Sound region prior to any further milling. The value of the exported logs is estimated at $68.1 million (approximately 57 percent of $120.0 million).

Logs not exported from the region are distributed to a variety of local industries, which are also identified by the commodity balance sheet for logging. Within the Coastal-Puget Sound region, sawmills, veneer and plywood manufacturing, and pulp mills (some of which are operated as part of paper and paperboard mills) make up the majority of the demand for logs. Using the input coefficients available from the IMPLAN database, this analysis distributes the logs not exported among these three industries. This distribution is shown in Table 47. Of those logs remaining in the region, nearly two-thirds go to sawmills, which accounts for about 29 percent of all logs if exports are included. The logs going to sawmills are valued at about $34.2 million as they enter the mill, and the milling process will add more value through lumber processing. Logs valued at about $7.9 million enter the veneer/plywood manufacturing process and logs valued at about $9.8 million go to pulp mills for further processing.

Table 47
Log Distribution within Coastal-Puget Sound Region

Category	Share of Total	Share of Logs Milled in Region
Exports	56.7%	n/a
Sawmills	28.5%	65.8%
Veneer/Plywood Manufacturing	6.6%	15.3%
Pulp Mills	8.2%	18.9%

Source: Coastal-Puget Sound IMPLAN model, Commodity Balance Sheet for Sector 14 Logging.

The value added by each of the milling processes is again calculated using the IMPLAN database. Logs purchased from the logging industry account for about 24 percent of the inputs to the sawmill industry. The other inputs include other goods and services purchased both from inside and outside the region, as well as labor and other business costs. In producing sawed lumber from the initial input of logs valued at $34.2 million, the added value of milling creates a product valued at nearly $143.8 million (approximately $34.2 million divided by 24 percent). In the case of veneer/plywood manufacturing, logs purchased from the logging sector make up about 23 percent of the value of inputs. The manufacturing process adds value to the initial $7.9 million in logs, resulting in veneer and plywood products valued at about $34.0 million (approximately $7.9 million divided by 23 percent).

[209] "Exports" refers to both domestic (outside of the Coastal-Puget Sound region but within the United States) and foreign (outside of the United States) trade. In either case, the logs leave the region prior to milling, and therefore the only economic impact felt within the region is that to the logging industry.

Pulp mills not only receive logs directly from the logging sector, but also utilize residue from sawmills and plywood/veneer manufacturers. This residue is identified by the commodity balance sheets for sawmills and veneer/plywood manufacturing. Just 0.1 percent of sawmill production and 0.25 percent of veneer/plywood production enter the pulp mill production process as raw materials. This residue is valued at about $53,000 as it enters the pulp mill, along with logs valued at about $9.8 million. According to the IMPLAN database, logging contributes about 14 percent of the dollar value of inputs to the pulp mill industry, while sawmills and veneer/plywood manufacturing contribute another 8 percent. The final value of the pulp mill production is about $44.0 million, which includes the initial $9.8 million of logs and $53,000 from the other wood industries plus value added through the milling process (approximately $9.8 million divided by 22 percent).

The regional economic impacts of the lost timber harvest are determined by entering these final value figures, which includes the value-added by each industry, into the I-O model for the region. The values that are input into the I-O model as direct impacts and the appropriate sectors are shown in Table 48. Because exports leave the region prior to further processing (milling), this figure is entered as a change in output for the logging industry. This will capture all of the backward linkages within the regional economy, including the changes in the forest nurseries, forest products, and timber tracts sector. The final value of the sawed lumber produced by sawmills is entered as a change to that sector, as with the veneer/plywood manufacturing and pulp mills sectors.

Table 48
Direct Impacts Applied to IMPLAN Model

IMPLAN Sector	Final Value
14 Logging	$68,080,000
112 Sawmills	$143,772,000
115 Veneer and Plywood Manufacturing	$34,024,000
124 Pulp Mills	$44,021,000
Total	**$289,898,000**

The results of the impact analysis are presented in Table 49. The initial change in output to the industries as described above totals $289.9 million. This initial change results in indirect impacts of $150.7 million, much of which are additional impacts in the logging industry triggered by the backward linkage of the mills to logging. Another $73.1 million of output is lost through induced impacts, which are primarily due to reduced household spending caused by job losses and income reductions. The total impact on output in the Coastal-Puget Sound region is estimated at about $513.7 million. Income, which includes both labor income and proprietor's income, is reduced by $67.4 million as a direct result of the change to the wood product and logging industries, and additional indirect and induced income losses are incurred. The total reduction in income for the region is estimated to be $136.6 million.

It is estimated that approximately 1,400 jobs would be lost as a direct effect of the reduction in timber harvest. These include jobs in the logging sector and the affected wood products manufacturing sectors.

Another 900 jobs would be lost as an indirect impact of the changes in timber harvest; a large number of these jobs would also be in the logging industry as part of the supply chain for the mills. Reductions in household expenditures caused by the lost jobs and income would induce the loss of another 750 jobs throughout the regional economy. Total employment losses are estimated at 3,050 jobs.[210]

Table 49
Regional Economic Impacts of Reduced Timber Harvest
Associated with Co-Extensive Salmon and Bull Trout Conservation Activities

Category	Direct	Indirect	Induced	Total
Output (dollars)	$289,898,000	$150,670,000	$73,116,000	$513,683,000
Income (dollars)	$67,441,000	$43,926,000	$25,203,000	$136,571,000
Employment (jobs)[a/]	1,400	900	750	3,050

a/ IMPLAN employment numbers are based on the number of jobs, whether full-time or part-time and are not the same as full-time equivalents.

Note: Numbers may not sum due to rounding.

3.6 EFFECTS ON ROAD MAINTENANCE AND TRANSPORTATION

This analysis examines the cost of past and future transportation projects in bull trout critical habitat. These may include the widening of a road, the reconstruction of a bridge, or the restoration of a ferry terminal. Past consultation history reveals that the Service has consulted on over 400 transportation-related projects since 1998. This cost analysis focuses on:

1. Roadwork - rehabilitation and new construction; and
2. Bridgework - rehabilitation and replacement.

Transportation projects can produce environmental impacts that disturb bull trout habitat directly (e.g., riparian destruction during a bridge replacement) or indirectly (e.g., degradation of habitat from stormwater run-off following a road widening). This analysis estimates economic impacts associated with bull trout conservation activities based on the cost of specific construction project modifications designed to reduce habitat impacts. These may include sediment control, water quality monitoring, spill prevention, and other such modifications. The impacts assessed in this analysis include both fixed costs (e.g., the cost of developing an erosion control plan) and variable costs depending on the miles of road construction (e.g., the cost of specific control measures).

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210 It is important to note that IMPLAN employment numbers are given in absolute job numbers, not full-time equivalents. Full-time and part-time jobs are counted equally (each as one job) within the IMPLAN database.

To estimate the location of both past and future road projects per watershed, this analysis relies on spatial data from the Washington Department of Transportation (WDOT). Spatial data is combined with typical project modification costs (fixed and variable) to develop a per project cost. These costs are then summed for each affected watershed.

3.6.1 Data Sources

This analysis relies on spatial data from WDOT for future (2004-2009) and past (1998-2003) road construction projects, including bridge construction. For cost information on conservation activities, this analysis relies on the *Integrated Streambank Protection Guidelines*,[211] published economic analyses, and various other cost studies. Table 50 presents a list of the typical conservation activities for road and bridge projects and the costs associated with these modifications.

3.6.2 Cost Estimation Methodology

This section describes the procedures (steps) involved in estimating the various cost components associated with transportation projects in the Coastal-Puget Sound region.

1. Estimate number and type (e.g., road or bridge) of future transportation projects likely to impact bull trout habitat for each watershed in the CHD based on GIS coverage of projected road projects from WDOT (2004–2009).[212] State and Federally funded road construction projects (i.e., excluding local and county projects) are included and all low impact projects unlikely to affect bull trout habitat are excluded.[213]

2. Identify typical bull trout conservation activities for both road and bridge construction projects and estimate typical costs associated with each (see Table 50).

3. Estimate total project costs for a typical transportation project. Total project costs are a function of both "fixed" and "variable" costs depending on the nature of the measure (see "Estimating Total Project Costs" below).

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[211] Washington Department of Fish and Wildlife, Washington Department of Transportation, and Washington Department of Ecology, April 2003, *Integrated Streambank Protection Guidelines,* http://wdfw.wa.gov/hab/ahg/ispgdoc.htm.

[212] Future (2004-2009) data provided through FTP download from Washington Department of Transportation, http://www.wsdot.wa.gov/mapsdata/geodatacatalog/default.htm, March 15, 2004.

[213] For example, road projects that are unlikely to impact water quality are excluded (e.g., repaving, safety-related, noise reduction-related, etc.). Personal communication with Pat Morin, Database Manager, Washington Department of Transportation, June 18, 2004.

Table 50
Conservation Activities Associated with Road Projects in Bull Trout CHD

Conservation Activities	Per Project Fixed Costs[a/]		
	Low	**Medium**	**High**
Pre-Construction Surveys	$4,900	$5,950	$7,000
Develop and implement a site-specific spill prevention, containment and control plan (SPCCP) and remove toxicants as they are released	$5,000	$7,500	$10,000
Water Quality Monitoring	$5,000	$17,500	$30,000
Excavation and relocation of materials during a project where they cannot enter wetlands	$1,000	$3,000	$5,000
Bank Stabilization	N/A	N/A	N/A
Maintain supply of emergency erosion control materials (slit fence and straw bales)	N/A	N/A	N/A
Use of boulders, rock, woody materials from outside of the riparian area	$500	$2,750	$5,000
Stormwater management activities	$2,000	$2,650	$3,300
Restoration of construction site through contouring, mulching, seeding and planting with native vegetation	N/A	N/A	N/A
Monitoring and evaluation both during and following construction	$4,400	$7,700	$11,000
Construction and implementation of cofferdam[b/]	$4,000	$6,000	$8,000
Ensure isolation of in-water work area and proper fish handling methods (hoop net sampling, electrofishing)[b/]	$1,000	$2,500	$5,000
Total	**$27,800**	**$55,550**	**$84,300**

a/ Size classification for fixed costs: <1 mile =Low; 1-10 miles = Medium; >10 miles = High

b/ These conservation activities only apply to bridge and road projects.

4. Assume the project life of each individual transportation project is six years[214] and that the likelihood of any road project occurring in a given year is evenly distributed.

5. Estimate annual cost of each project by adding fixed project costs to variable costs and dividing by expected project life.

[214] This analysis assumes project life is six years based on years of available GIS data.

6. Multiply annual project cost by number of affected transportation projects to estimate total annual impacts (see Table 51).

7. For the prospective analysis, economic impacts occurring in "nearshore marine habitat HUCs" are excluded to reflect the fact that most transportation projects are found inland and therefore unlikely to incur costs associated with the proposed designation.

Table 51
Calculation of Prospective Transportation Costs
Associated with Co-Extensive Salmon and Bull Trout Conservation Activities

Road Project Type	Total No. of Road Projects	Fixed Project Cost[a/]	Variable Project Cost	Years of Trans-portation Data	Total Annual Costs[b/]
Road - Small	131	$22,800	Varies by project; function of project length (miles)	6	$764,000
Road - Medium	91	$47,000			$924,000
Road - Large	13	$71,300			$207,000
Bridge - Small	57	$27,800			$379,000
Bridge - Medium	5	$55,500			$57,000
Bridge - Large	1	$84,300			$20,000
Total	**298**				**$2,351,000**
Impacts Co-Extensive with Salmon and Bull Trout[c/]					**$1,775,000**

[a/] Fixed project costs are derived in Table 50 and vary depending on whether the project is a road or bridge project.

[b/] Total annual costs are equal to fixed project costs plus variable project costs (varies by length of road segment), divided by the number of years of transportation data.

[c/] Total costs exclude economic effects occurring in "nearshore marine habitat HUCs" to reflect the fact that inland transportation projects are unlikely to incur costs associated with the proposed designation.

8. Estimate the present value of costs over a 20-year time frame of the analysis, using a three and seven percent discount rate.

9. To estimate retrospective costs, this analysis identifies the number and type (e.g., road or bridge) of past transportation projects that impacted bull trout habitat for each watershed based on GIS coverage of historic capital improvement projects from WDOT (1998–2003).[215]

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[215] Data on Six-Year Capital Improvements (1998-2003) provided through personal communication with Michelle Blake, GIS Analyst, Washington Department of Transportation, June 15, 2004.

10. This analysis multiplies the number of historic road projects per watershed by the fixed and variable costs as described for perspective projects above and then multiplies by 6.5 years, the time since the bull trout was first proposed for listing (1998) to present (through 2004) (see Table 52).

Table 52
Calculation of Retrospective Transportation Costs
Associated with Co-Extensive Salmon and Bull Trout Conservation Activities

Road Project Type	Total No. of Road Projects	Fixed Project Cost[a/]	Variable Project Cost	Years Covered by Retrospective Analysis	Years of Trans-portation Data	Total Costs 1998–2004[b/]
Road - Small	194	$22,800	Varies by project; function of project length (miles)	6.5	6.0	$7,348,000
Road - Medium	78	$47,000				$5,154,000
Road - Large	5	$71,300				$501,000
Bridge - Small	77	$27,800				$3,334,000
Bridge - Medium	12	$55,500				$905,000
Bridge - Large	2	$84,300				$243,000
Total	**368**					**$17,485,000**
Impacts Co-Extensive with Salmon and Bull Trout[c/]						**$17,472,000**

[a/] Fixed project costs are derived in Table 50 and vary depending on whether the project is a road or bridge project.

[b/] Total costs 1998-2004 are equal to fixed project costs times variable project costs (varies by length of road segment), times the number of years covered by the retrospective analysis, divided by the number of years of transportation data.

[c/] Total costs exclude economic effects occurring in "nearshore marine habitat HUCs" to reflect the fact that inland transportation projects are unlikely to incur costs associated with the proposed designation.

11. For the retrospective analysis, economic impacts occurring in "nearshore marine habitat HUCs" are excluded to reflect the fact that most transportation projects are found inland and therefore unlikely to incur costs associated with the proposed designation.

3.6.2.1 Estimating Total Project Costs

Total project costs associated with transportation-related conservation activities are a function of both "fixed" and "variable" costs depending on the nature of the measure. Fixed costs are incurred once in the course of a project, may not vary dramatically with project size (e.g., costs of water quality monitoring), and are categorized as low, medium, and high to provide a range of potential costs for each measure (Table 50). Variable costs are based on per mile estimates of activities that are a function of project size. The following discussion provides examples of the estimation of total project cost as a function of both fixed and variable costs.

Equation 1: Total Fixed Cost (TFC) = (Fixed costs of conservation measure A) + (Fixed costs of conservation measure B) + (Fixed costs of conservation measure C) + ... etc.

In contrast to fixed costs, some costs are highly dependent on the length of a transportation project, and can be calculated based on the linear feet of stream that a typical project impacts. These "variable" costs may include restoration efforts, bank stabilization, and emergency erosion control. To derive a relationship between project length and stream length impacted, this analysis uses data from biological opinions to develop the following relationship:[216]

Equation 2: Stream Length Impacted (SLI) (ft.) = 2 * Road Length (miles) + 100

After identifying the extent of stream that may be impacted by a project, this analysis calculates a total impact based on total fixed and variable costs:

Equation 3: Total variable cost = (conservation measure costs) * (SLI)

Equation 4: Total impact = Total Variable Cost + Total Fixed Cost

3.6.2.2 Summary of Potential Economic Impacts Associated with Transportation Projects

As shown below in Table 53, the total annualized impacts associated with transportation projects are approximately $1.8 million, or about three percent of the total impact of bull trout conservation activities within proposed critical habitat.

Table 53
Potential Economic Impacts on Road Maintenance and Transportation Associated with Co-Extensive Salmon and Bull Trout Conservation Activities

Coastal-Puget Sound	Retrospective (Total)	Prospective (Total)		Prospective (Annualized)
		3%	7%	
Proposed Critical Habitat	$17,472,000	$26,409,000	$18,806,000	$1,775,000
Proposed for Exclusion	$0	$0	$0	$0
Excluded	$0	$0	$0	$0

Note: Total figures include activities that occur spatially within a 5th Field HUC, including those that occur just outside a HUC watershed but within a WRIA.

216 This equation was derived by creating a line of best fit through data points from biological opinions.

3.6.3 ASSUMPTIONS AND UNCERTAINTIES

Table 54
Assumptions and Uncertainties

Assumption	Direction of Bias
Projects occurring between 2004 and 2009 are indicative of the same types and location of road projects likely to continue into the future over the 20-year period of the analysis.	+/-
Project modifications included in Table 50 are indicative of typical fish-related conservation activities.	+/-
The extent to which an individual road project impacts a certain length of stream varies with the length of the project (variable costs) and is best approximated through the data points provided by historic biological opinions. That is, for a sample of biological opinions on transportation-related projects, this analysis assumes a given project will result in economic impacts that are proportional to the length of stream impacted.	+/-
To account for the costs of conservation activities that are for the benefit of bull trout and listed salmon species, the analysis attributes the costs of the fish-related conservation activities co-extensively to both species.	+

+: This assumption is likely to produce an upward bias in cost estimates.

-: This assumption is likely to produce a downward bias in cost estimates.

+/-: No direction of bias can be determined.

3.7 EFFECTS ON AGRICULTURE AND GRAZING

Agriculture is an important economic activity within the Coastal-Puget Sound area. A variety of crops including vegetables, hay, berries, and row crops are produced in the region. Approximately 820,000 acres within the proposed CHD for the Coastal-Puget Sound population of bull trout are in agricultural use. Of this, more than 140,000 acres are irrigated. In many cases, the lands used to produce agricultural products are located adjacent to or near streams that contain or flow into bull trout habitat. Consequently, activities associated with agricultural practices can affect bull trout. For example, the use of dikes and other water control structures to prevent flooding of agricultural fields have resulted in a reduction in the amount of estuarine and wetland habitat, which is important to many aquatic species including bull trout. In addition, water diversions for irrigation can impact bull trout directly at the diversion structure and downstream through a reduction in stream flows.

In regions where Federal agricultural projects are present, studies are being conducted to determine the effects of project operations on bull trout.[217] In the future, the Federal facilities that supply water to

[217] Personal communication with Mike Padilla, USACE, May 27, 2004.

agricultural lands may be required to undertake conservation activities for bull trout. Activities may include modifications to existing facilities such as installation of fish passage and changes in reservoir releases. However, there are no Federal irrigation projects within proposed CHD for the Coastal-Puget Sound population of bull trout. Consequently, there is rarely a Federal nexus present to prompt section 7 consultations. In fact, there have been no bull trout consultations for agricultural projects or water diversions.[218]

According to one agricultural industry representative, there have not been any specific impacts attributable to bull trout in western Washington to date.[219] However, the representative was cautious about the future and the potential for Act-related lawsuits to require changes in agricultural practices on private land and irrigation diversions. In recent years, efforts have focused on impacts on Chinook salmon of diking activities in sub-tidal agricultural land and associated wetland loss. In addition, there are ongoing discussions over establishment and management of riparian buffers in many watersheds to protect water quality and fish habitat in general. Neither of these efforts has resulted in any measurable economic impact on agricultural production that can be attributed to bull trout. For example, restrictions on land use within established buffers only apply to new development on the property and existing agricultural development would be unaffected. Any changes to existing agricultural uses within riparian buffers would be voluntary and can often be compensated through programs such as the Conservation Reserve Enhancement Program (CREP), administered by the Natural Resource Conservation Service (NRCS).

Irrigation diversions are required to install and maintain fish screens to prevent entrainment of fish species. Washington State Laws RCW 77.16.220, RCW 77.55.040, and RCW 77.55.070 regulate the screening criteria for agricultural diversions. In general, these criteria establish the location, mesh size, minimum area, and fish bypass requirements for all screens and establish penalties for non-compliance.[220] Installation and maintenance of fish screens is costly. Capital costs can range between $2,000 and $5,000 per cubic foot per second (cfs) diverted and these costs depend upon many factors, including the size of the diversion.[221] The WDOE administers fish screening requirements on agricultural diversions through issuance of water rights. Specific screening criteria are specified in Hydraulic Project Approvals (HPA) issued by the WDFW. These requirements have been in place for many years in Washington and have not been modified to address concerns over a specific species such as bull trout. However, enforcement

218 U.S. Fish and Wildlife Service, 2004, "Log of Section 7 Consultations," database of historic section 7 consultations for bull trout maintained by Lacey, Washington, Field Office..

219 Personal communication with Mike Shelby, Manager, Western Washington Agricultural Association, May 2004.

220 Washington Department of Fish and Wildlife, "Screening Requirements for Water Diversions," http://wdfw.wa.
gov/hab/engineer/fishscrn.htm, accessed May 28, 2004.

221 Personal communication with Bryan Nordlund, Hydraulic Engineer, NOAA Fisheries, Northwest Region, Hydropower Division, May 2004.

effort of the existing regulations has been targeted on watersheds that contain listed species. Currently, NOAA is developing a new set of standard criteria for fish screening that, once completed, will be adopted by WDFW.[222] These criteria will be uniform across all streams without regard for the presence of listed species.[223] Consequently, this analysis does not assign any costs attributable to bull trout conservation activities due to fish screening requirements.

There are no examples in western Washington where concerns related to the Act have resulted in mandated changes in irrigation diversions. However, there have been voluntary agreements negotiated between irrigators and State agencies in an effort to improve streamflows for the benefit of salmonids in some basins. For example, the WDOE Water Resources Program has negotiated water leases in the Dungeness River Basin since 2001 to augment streamflows during critical salmon spawning periods. In 2003, WDOE paid approximately $245,000 to irrigators to allow water to remain in the stream.[224] In addition to the Dungeness Basin, WDOE's Water Acquisition Program has targeted several other basins within the Coastal-Puget Sound area for future streamflow augmentation through voluntary water right leases and purchases. These basins include the Nooksack, Snohomish, Cedar-Sammamish, Duwamish-Green, Chambers-Clover, and Quilcene-Snow. The Water Acquisition Program was primarily established to benefit salmon rather than bull trout and only those basins in which instream flows were identified as a limiting factor to salmon production due to water diversions are targeted by the program.[225] However, the program benefits many species, including bull trout.

In addition to the instream flow leasing program administered by WDOE, irrigation districts in the Dungeness Basin developed a Comprehensive Water Conservation Plan to explore alternatives for increasing streamflows for the benefit of Federal listed species, including bull trout. The recommended plan identified projects capable of conserving between 28 and 33 cfs at a cost of $9.3 to $12.0 million.[226] Through funding from a variety of State and Federal programs, more than $1.3 million has been expended to date on irrigation system improvements and water conservation activities.[227] Through a Trust Water Rights agreement, two-thirds of the conserved water will remain instream. The Dungeness Water Users Association, a private irrigation group, is generally required to contribute 15 percent of the funding for the conservation improvements.

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[222] Personal communication with Eric Egbers, Washington Department of Fish and Wildlife, May 2004.

[223] Personal communication with Bryan Nordlund, Hydraulic Engineer, NOAA Fisheries, Northwest Region, Hydropower Division, May 2004.

[224] Washington Department of Ecology, August 25, 2003, "Water Right Leases Help Increase Streamflows in the Dungeness," press release.

[225] Washington Department of Ecology, January 2003, "Washington Water Acquisition Program."

[226] Montgomery Water Group, October 1999, "Dungeness River Agricultural Water Users Association Comprehensive Water Conservation Plan," prepared for Washington Department of Ecology.

[227] Personal communication with Cynthia Nelson, Washington Department of Ecology, Water Resources Program, May 2004.

In other parts of Washington, private irrigation districts have been subjects of enforcement action under section 9 of the Act with regard to listed bull trout and salmon. In the Walla Walla basin during 2000, the Walla Walla River Irrigation District and the Hudson Bay District Improvement Company received a letter from the Service warning of potential violations of the Act due to low flow conditions caused by irrigation diversions.[228] In response, the irrigation districts took voluntary actions to respond to the Service's concerns and maintain minimum flows in the Walla Walla River. The districts and the Service reached an interim settlement agreement that avoided litigation and allowed irrigation diversions to continue. An HCP and Comprehensive Irrigation District Management Plan are currently being developed to address future water management in the basin.

In the Methow Basin in north-central Washington, NMFS joined a lawsuit against a group of private irrigators diverting water from the Methow River into a canal system in 2001. The diversion, combined with existing low-flow conditions, generated concern for salmon listed under the Act, as well as bull trout. The lawsuit led to a decision to temporarily stop diversions into the canal during the 2001 irrigation season. This action resulted in crop losses as well as considerable uncertainty regarding future water supplies in the basin. Currently, irrigators are working with State and Federal agencies to improve conveyance efficiencies in an effort to maintain streamflows as well as the irrigated land base.

The two cases described above both occurred outside of the Coastal-Puget Sound area and involved groups of water users that rely upon a common irrigation conveyance system. This type of infrastructure is less common in the Olympic Peninsula and Puget Sound region, where single irrigators diverting directly from a stream conduct the majority of the irrigation.

As described above, there are isolated examples where the listing of bull trout has been a primary factor in prompting changes to private irrigation projects and practices to avoid lawsuits and assessment of penalties under section 9 of the Act. In rare cases outside of the Coastal-Puget Sound area, this has led to temporary reductions in irrigation water supply, which has imposed economic costs on agricultural producers and communities due to foregone crop production. Similar issues could arise in other locations in the future. However, it is not possible to predict where and when such activities may occur and what the outcomes will be. Based upon the information presented above, this analysis concludes that future conservation activities requiring changes to agricultural practices and irrigation diversions on private land associated with bull trout are unlikely and unpredictable. Consequently, no costs due to bull trout conservation activities are assigned to agricultural activities.

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[228] Personal communication with Dave Fillippi, Stoel Rives, July 1, 2004.

3.8 EFFECTS ON COMMERCIAL AND RECREATIONAL MINING OPERATIONS

3.8.1 INTRODUCTION

Sand and gravel are important and abundant economic resources in western Washington that support development activities such as residential and commercial construction and road building. In 2002, 215 sand and gravel operations produced 43.2 million metric tons with a value of $223 million in the State.[229] Due to the costs of transporting the material, sand and gravel mines tend to be located in areas relatively near development. Some of these mines have historically been, and continue to be located within flood plains and can directly impact bull trout habitat.

Sand and gravel extraction methods vary widely across mine locations and operations and typically depend upon the nature of the deposit and operator preference. Where mining occurs above the water table, conventional earth moving equipment is often employed. In cases where the mine penetrates the water table, draglines or floating barges using hydraulic methods are often used. Excavation typically occurs during periods of low water levels.

The environmental impacts of sand and gravel mining vary widely by location and extraction method but can include erosion, loss of habitat, and degradation of water quality.[230] A primary impact associated with mining activities in or near streams arises from the removal of more gravel than can naturally be replenished by the system.[231] Excess gravel removal can cause changes in the channel and flow resulting in degradation of habitat conditions for aquatic species, including bull trout. One measure taken to minimize the impact of sand and gravel mining from active river channels includes restricting sand and gravel extraction rates to the amount of sediment that is transported by the stream during a given period.[232] Other activities include locating settling ponds for sand and gravel wash water away from the waterway to prevent the water from entering the stream, and timing extraction to avoid fish spawning periods. While the environmental impacts tend to be negative, it has also been observed that mine reclamation activities often create new fish habitat that is suitable for some species. For example, ponds that are connected to a stream have been found to benefit juvenile salmonids.[233]

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[229] Bolon, W.P., 2003, “Construction Sand and Gravel,” United States Geological Survey.

[230] U.S. Fish and Wildlife Service, 2004, *Draft Recovery Plan for the Coastal-Puget Sound Distinct Population Segment of Bull Trout (Salvelinus confluentus),* “Volume I (of II): Puget Sound Management Unit,” and “Volume II (of II): Olympic Peninsula Management Unit,” Portland, Oregon.

[231] Langer, W. H., 2002, “A General Overview of the Technology of In-Stream Mining of Sand and Gravel Resources, Associated Potential Environmental Impacts, and Methods to Control Potential Impacts,” Open-File Report OF-02-153, U.S. Geological Survey.

[232] Ibid.

[233] Norman, D. K., C. J. Cederholm, and W. S. Lingley, September 1998, “Flood Plains, Salmon Habitat, and Sand and Gravel Mining,” *Washington Geology*, Vol. 26, No. 2/3.

3.8.2 BACKGROUND

Sand and gravel mining in Washington is primarily regulated through the Shoreline Management Act (RCW 90.58), administered by cities and counties. Local governments also regulate sand and gravel mining through conditional use permits, land use ordinances, and the Growth Management Act (RCW 36.70A).[234] Sand and gravel operations that affect the natural flow or bed of any waters of the State require a Hydraulic Project Approval (HPA) from the WDFW. However, an HPA is not typically required if mining does not occur within the active channel. The Washington Department of Natural Resources (WDNR) is responsible for enforcing the Surface Mine Reclamation Act (RCW 78.44) which determines when and how mines are reclaimed. In 1993, the law was amended and now requires most mines within flood plains to be converted to wetlands.

The SMA applies to mining activities within the 100-year flood plain. However, regulation can vary by local jurisdictions. Generally, sand and gravel mining within 200 feet of the floodway or within the 100-year flood plain is discouraged pursuant to WDOE's 1994 Shoreline Management Guidebook. In addition, counties such as Grays Harbor have required reduced rates of gravel removal from gravel bars in some locations in order to minimize potential environmental effects.[235] Due in part to existing environmental regulations, the majority of sand and gravel mines in flood plains are located away from the active stream channel and instream mining is a relatively uncommon practice.[236] In addition, the majority of new large mining operations are being sited in upland areas due to the environmental requirements associated with mining within the flood plain.[237]

The USACE also regulates sand and gravel mining in flood plains through sections 401 and 404 of the CWA (Title 33), or under section 10 of the Rivers and Harbors Act of 1899. However, not all mines within flood plains are required to apply for a USACE permit. In general, a USACE permit is required if it is determined that the mining activity may affect the river or stream. In recent years, the USACE has received relatively few applications for mining permits.[238]

The consultation record for the Coastal-Puget Sound population of bull trout shows one informal consultation on gravel excavation. This consultation occurred because it involved gravel removal within the Olympic National Park in order to protect a bridge from damage during high water events. According

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234 Ibid.

235 Personal communication with Jane Hewitt, Grays Harbor County Planning Department, June 9, 2004.

236 Personal communication with Bruce Chattin, Executive Director, Washington Aggregates and Concrete Association, June 10, 2004.

237 Personal communication with David Norman, Assistant State Geologist, Washington Department of Natural Resources, Division of Geology and Earth Resources, May 26,2004.

238 Personal communication with Ann Uhrich, North Section Chief, USACE – Seattle District, Regulatory Division, June 8, 2004.

to Service personnel, consultations on mining activities are uncommon because there is rarely a Federal nexus present.[239]

3.8.3 Analysis

This analysis considers the economic impact of bull trout conservation activities associated with sand and gravel mines located within flood plains (upland mines are considered sufficiently removed from bull trout habitat to avoid the need for conservation activities). The economic impacts attributable to mining-related conservation activities are considered relevant to this analysis because the bull trout recovery plan for Puget Sound and Olympic Peninsula identifies mining as one reason for the decline of bull trout.[240]

A GIS coverage of sand and gravel mines within flood plains in Washington was obtained from WDNR.[241] This coverage includes the permit number, permitted acres, mined acres, status, mined volume, distance from the river, and a field indicating if the mine has a surface water connection to the river system. Table 56 contains a summary of the mines identified in this coverage.

The added costs of bull trout conservation activities vary widely among locations and are difficult to quantify. Environmental regulations have increased the costs of sand and gravel mining within flood plains and pushed new mining activities into upland areas in some cases.[242] This has resulted in higher transportation costs for the operators as they locate greater distances from the market. In addition, upland gravel mining tends to produce a different quality product so it is not necessarily a substitute for flood plain gravel mining. Flood plains tend to produce round rock, which is the preferred material for some applications, including cement manufacturing.[243]

The bull trout consultation record for sand and gravel mining in the Coastal-Puget Sound area is inadequate to provide an indication of the conservation activities that are typically required. In order to address this issue, common conservation activities associated with sand and gravel consultations for

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239 Personal communication with Service Biologist, Western Washington Fish and Wildlife Office, Lacey, Washington, May 2004.

240 Specifically the report notes, "Land and water management activities that depress bull trout populations and degrade habitat include forest management practices, livestock grazing, agriculture, agricultural diversions, road construction and maintenance, mining, and urban and rural development." U.S. Fish and Wildlife Service, 2004, *Draft Recovery Plan for the Coastal-Puget Sound Distinct Population Segment of Bull Trout (Salvelinus confluentus),* "Volume II (of II): Olympic Peninsula Management Unit," Portland, Oregon, p. 70.

241 Baker, L. R., March 2003, "Digital Inventory of Flood-Plain Mines in Washington State," Washington Department of Natural Resources, Division of Geology and Earth Resources.

242 Personal communication with Bruce Chattin, Executive Director, Washington Aggregates and Concrete Association, June 2004.

243 Ibid.

salmon were explored.[244] The salmon consultation record for sand and gravel mining is limited as well.[245] Biological opinions have primarily been issued on sand and gravel mines that operate within the active stream channel. Consultations on off-channel mining operations were not found in the historic record.

The most complete description of costs associated with conservation activities is described in a recently completed HCP for a proposed sand and gravel mine on the East Fork of the Lewis River.[246] A selection of the conservation activities and associated per acre costs are provided in Table 55 below. The East Fork of the Lewis River is within the Columbia River Basin and therefore outside of the Coastal-Puget Sound CHD. However, for the purpose of this analysis, the activities are assumed to be similar enough to those that might be required at floodplain mining sites in the affected area.

Table 55
Estimated Costs of Conservation Activities at the Proposed Daybreak Mine

Conservation Measure	Total Cost (Years 0-25)	Cost/Acre (Years 0-25)	Annual Cost/Acre
Monitoring Program	$590,000	$2,360	$94
Wash Water Clarification Process	$4,136,000	$16,544	$662
Mining and Reclamation Designs to Address Avulsions	$580,000	$2,320	$93
Contingency Plan for Potential Avulsions	$465,000	$1,860	$74
Riparian Management Zone (buffer)	$160,000	$640	$26
In-Channel Habitat Enhancement	$6,000	$24	$1
Offsite Floodplain Enhancement	$250,000	$1,000	$40
Shallow Water and Wetland Habitat	$346,000	$1,384	$55
Total	**$6,533,000**	**$26,132**	**$1,045**

Source: R2 Resource Consultants, Inc., November 2003, "Storedahl Daybreak Mine HCP," pp. 7-1 through 7-12.

As shown in Table 55, mining-related conservation activities provide for improved water quality through modifications to extractive activities as well as post-mining habitat enhancement. Total costs are based on an analysis conducted for the Storedahl Daybreak Mine HCP. Total annual per acre costs are developed for the purpose of this analysis and applied to the mining operations within the bull trout CHD. The steps to estimating annual economic impacts include the following:

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244 As is the case with most activities analyzed in this report, the analysis assumes that sand and gravel conservation measures taken to protect anadromous salmon are also protective of bull trout populations.

245 Review of NOAA Fisheries Consultation database for salmon.

246 R2 Resource Consultants, Inc., November 2003, "Storedahl Daybreak Mine HCP."

1. The analysis assumes that sand and gravel mining in the active stream channel is an uncommon practice within the Coastal-Puget Sound area.[247] As a result, there is unlikely to be a significant number of section 7 consultations on sand and gravel mining.

2. Identify potential number of sand and gravel operations within bull trout CHD through GIS analysis.[248]

3. Assume that sand and gravel mines located 200 feet or less from the active stream channel will incur costs associated with section 7 consultations with the USACE over the next 20 years. It is further assumed that each of these mines has an equal probability of bearing these costs over the time period. In addition, it is assumed that no new gravel mines will be located within 200 feet of the active river channel in the future.

4. Exclude mines identified as "terminated" (i.e., no longer active) and include mines identified as "active" and "pre-dating permit requirements" (see Table 56).

5. Exclude mines that do not fall into HUC watersheds being proposed for CHD.

Table 56
Summary of Sand and Gravel Mine Operations in Washington State

General Sand and Gravel Mining Operation Characteristics	
Average Mined Area (acres)	26
Average Distance from Streams (feet)	1,261
Average Total Extraction (mil cubic yards)	1,700,000
Identification of Impacted Mining Operations in Bull Trout CHD	
Total Mines in Washington State	936
Total Mines in Bull Trout CHD	58
Terminated Mines	20
Active Mines	19
Pre-dating Permit Requirements	19
Total Mines Eligible for Consideration in Analysis	**38**
Total Mines within Bull Trout CHD[a/]	**10**

[a/] Note that all ten mines considered to impact bull trout are located immediately adjacent to stream segments that are proposed for critical habitat.

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[247] Personal communication with David Norman, Assistant State Geologist, Washington Department of Natural Resources, Division of Geology and Earth Resources, May 26, 2004.

[248] Baker, L. R., March 2003, "Digital Inventory of Flood-Plain Mines in Washington State," Washington Department of Natural Resources, Division of Geology and Earth Resources.

6. Multiply the annual per acre cost of conservation activities ($1,045) by the size of each active mine within the affected area to obtain the total annual costs. Where data are available, this calculation relies on the area of the permitted mining operation; otherwise, the actual mined area (as determined through GIS analysis) is used as a proxy (see Table 57).

7. To estimate total prospective costs for these activities, calculate the total present value of annual costs over the 20-year period of the analysis, using a three and seven percent discount rate. Retrospective costs are zero because sand and gravel mining activities have not been consulted on for bull trout since the listing within the proposed CHD for the Coastal-Puget Sound population of bull trout.

Table 57
Calculation of Economic Costs from Mining Facilities within Bull Trout Affected Area[a/]

MINE ID	Watershed	Salmon Overlap	Size of Mine[b/]		Annual Per Acre Cost	Total Annual Cost[c/]
			Mined Area (acres)	Permitted Area (acres)		
241	Lower Chehalis	No	21.990	n/a	$1,045	$23,000
216	Lower Chehalis	No	43.530	41		$42,800
237	Lower Chehalis	No	44.820	80		$83,600
231	Lower Chehalis	No	41.170	n/a		$43,000
215	Lower Chehalis	No	21.670	35		$36,600
240	Lower Chehalis	No	12.440	n/a		$13,000
246	Snohomish	Yes	20.120	20		$20,900
249	Stillaguamish	Yes	12.450	21		$21,900
251	Upper Skagit	Yes	23.760	n/a		$24,800
254	Upper Skagit	Yes	25.020	45		$47,000
					Total	**$357,000**

Note: "n/a" indicates that data are not available.

[a/] All mines shown are within 200 feet or less of active stream channel designated as proposed critical habitat.

[b/] Size of mine relies on mined acres as described in WDNR database where data are available. Otherwise, size of mine relies on permitted acres based on GIS analysis of mine site.

[c/] Total annual impacts calculated based on annual per acre cost and mined area.

8. The adjustment for "nearshore marine habitat HUCs" is not applicable to mining activity because no impacted mines are located in marine-only watersheds.

Ten sand and gravel mines in the proposed Coastal-Puget Sound CHD operate within 200 feet of the active stream channel. They range in size from 2 to 45 acres and have mined between 150,000 and 4.3

million cubic yards each since operations began. Annual costs are assigned to each mine on a per acre basis according to the costs provided in Table 55. In total, costs are assigned to 341 acres of affected mines resulting in an annualized cost of $357,000 (see Table 58).

Table 58
Potential Economic Impacts on the Sand and Gravel Mining Industry Associated with Co-Extensive Salmon and Bull Trout Conservation Activities

Coastal-Puget Sound	Retrospective (Total)	Prospective (Total)		Prospective (Annualized)
		3%	7%	
Proposed Critical Habitat	$0	$5,309,000	$3,780,000	$357,000
Proposed for Exclusion	$0	$0	$0	$0
Excluded	$0	$0	$0	$0

3.8.4 ASSUMPTIONS AND UNCERTAINTIES

Table 59
Assumptions and Uncertainties

Assumption	Direction of Bias
All sand and gravel mines within 200 feet of the active river channel will incur Section 7 costs.	+/-
Assume that, despite few sand and gravel mining operation permits with the USACE in active river channels, future permits may be granted at existing sites as identified through GIS analysis.	+
This analysis assumes that bull trout listing and CHD have not reduced the regional availability of sand and gravel.	-
Conservation activities from a single sand and gravel operation within the Columbia River basin are applied in this analysis. The small sample may not accurately reflect the range of costs that could potentially be incurred at other locations. However, for the purpose of this analysis, the activities are assumed to be similar enough to those that might be required at floodplain mining sites in the affected area.	+/-

+: This assumption is likely to produce an upward bias in cost estimates.

-: This assumption is likely to produce a downward bias in cost estimates.

+/-: No direction of bias can be determined.

3.9 EFFECTS ON RECREATION

This analysis examined recreation use at North Cascades, Olympic, and Mt. Rainier National Parks, and the Olympic and Mount Baker-Snoqualmie National Forests. Effects to recreation use and access resulting from bull trout conservation activities may include decreased access to quality fishing experiences due to reduced stocking, reduced campground or day use area access, decreased recreation area and wilderness area access due to road closures; and hunting activity decreases due to area or road closures that could affect outfitter guide services.

3.9.1 Recreation Environment

Existing recreation conditions in the Coastal-Puget Sound area are described below. The discussion begins with national parks, followed by national forests.

3.9.1.1 North Cascades National Park

Outdoor recreation in North Cascades National Park (684,300 acres) includes backcountry camping, car camping, picnicking, hiking, mountain climbing, fishing, horseback riding, wildlife and bird watching, scenery viewing, boating. Approximately 524,000 acres of watershed within the Park are included in the proposed bull trout CHD.[249]

Facilities at the park include hiking trails, horse rentals nearby, small boat rentals, and professional guide, climbing, and pack train services for backcountry excursions.[250] Hiking is the most popular means for exploring the park interior with 386 miles of trails. There are also opportunities for backcountry fishing within the park.[251]

Fishing activity at North Cascades National Park includes fishing for native Rainbow, Cutthroat and Eastern Brook trout in Ross Lake. A Washington State fishing license is required for the Ross Lake fishing season of July 1 through October 31. A limit of three rainbow trout per day at least 13" applies. Closed waters on Ross Lake include all of Ruby Creek, ¼ mile upstream from closed markers at the mouth of Big Beaver, and one mile up stream on all other tributaries.[252]

North Cascades National Park has several lakes that are used by anglers including Chelan, Ross, George, Diablo, and several smaller lakes including Blum, No Name, Green, Hanging, Kettling, Sandy, and Trapper. Angling at these lakes is considered light to moderate.[253] The park has two rivers used by anglers, the Skagit and Stehekin rivers.

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249 NEA GIS analysis.

250 National Park Service, "North Cascades National Park: Activities," http://www.nps.gov/noca/pphtml/activities.html, accessed June 2, 2004.

251 GORP, "North Cascades National Park," http://gorp.away.com/gorp/resource/us_national_park/sum_pick7.htm, accessed June 2, 2004.

252 National Park Service, October 28, 1998 (last updated), "North Cascades National Park: Fishing Regulations," http://www.nps.gov/noca/fishing-regs.htm, accessed May 28, 2004.

253 GORP, "North Cascades National Park: Fishing," http://gorp.away.com/gorp/resource/us_national_park/wa/fish_nor.htm, accessed June 2, 2004.

Sections of the Lower and Upper Skagit core areas are within the boundaries of the park. This area provides spawning and rearing habitat for bull trout and protects some of the bull trout habitat in Washington. North Cascades National Park staff are undertaking aquatic habitat monitoring, inventories of fish populations throughout unsurveyed watersheds within the park, and they are inventorying and replacing or modifying road culverts that will assist bull trout recovery in Puget Sound.[254]

Restrictive fishing regulations are in effect in most places for bull trout to help restore a wild and healthy population. These regulations also apply to Dolly Varden trout, because they are difficult to distinguish from bull trout, and it is further stated that, "It is illegal to take bull trout from any lake or pond within the park and recreation areas."[255]

3.9.1.2 Olympic National Park

Outdoor recreation in Olympic National Park (922,700 acres) includes auto touring, backpacking, biking, bird watching, boating, camping, climbing, cross country skiing, fishing, hiking, horseback riding, interpretive programs, kayaking, mountaineering, nature walks, snow skiing, snowshoeing, stargazing, swimming, whitewater rafting, and wildlife viewing. Approximately 816,000 acres of watershed within the Park are included in the proposed bull trout CHD.[256]

Fishing is not a common activity at the Olympic National Park. Anglers can fish for steelhead, cutthroat and rainbow trout. Dolly Varden can also be found in park waters.[257] In places where bull trout are found, restrictions may apply to Dolly Varden because the two species appear similar. Saltwater angling on the coast includes several types of rockfish, saltwater perch, greenlings, and Pacific cod.[258] Park lakes used by anglers include Crescent, Mills, Cushman, Quinault, and Ozette, while rivers used by anglers include the Hoh, Soleduck, Quillayute, Queets, Quinault, Salmon, Duckabush, Skokomish, Dosewallips, Elwha, and Gray Wolf.

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[254] U.S. Fish and Wildlife Service, 2004, *Draft Recovery Plan for the Coastal-Puget Sound Distinct Population Segment of Bull Trout (Salvelinus confluentus),* "Volume I (of II): Puget Sound Management Unit," Portland, Oregon.

[255] National Park Service, October 28, 1998 (last updated), "North Cascades National Park: Fishing Regulations," http://www.nps.gov/noca/fishing-regs.htm, accessed May 28, 2004.

[256] NEA GIS analysis.

[257] GORP, "Olympic National Park: Fishing," http://gorp.away.com/gorp/resource/us_national_park/wa/fish_oly.htm, accessed June 2, 2004.

[258] Ibid.

Olympic National Park contains undisturbed habitat that provides important high quality spawning and rearing habitat for bull trout and protects some of the last undisturbed bull trout habitat in Washington.[259] The Park currently undertakes conservation, research, and restoration that will assist bull trout recovery on the Olympic Peninsula.

3.9.1.3 Mount Rainier National Park

Outdoor recreation in Mount Rainier National Park (235,600 acres) includes auto touring, backcountry camping, biking, car camping, cross country skiing, picnicking, hiking, mountain climbing, fishing, horseback riding, wildlife and bird watching, scenery viewing, interpretive programs, nature walks, snow skiing, and snowshoeing. Approximately 130,000 acres of watershed within the Park are included in the proposed bull trout CHD.[260]

Boating and non-motorized boating is permitted on all lakes except Frozen, Reflection, Ghost, and Tipsoo. Closed waters include: Klickitat Creek above the White River entrance water supply intake; Ipsut Creek above the Ipsut Creek campground water supply intake; Laughingwater Creek above the Ohanapecosh water supply intake, Frozen Lake, Reflection Lakes, Shadow Lake, and Tipsoo Lake.

Fishing at Mount Rainier National Park is not a popular recreational activity. Park waters are not stocked, and populations depend on natural reproduction to replenish. The park encourages anglers to use barbless hooks and artificial lures to avoid harming catch and release fish.[261] Fish that are commonly found within the boundaries of Mount Rainier National Park include Brook trout, Dolly Varden, Cutthroat trout, Rainbow trout, and Kokanee Salmon.

Park fishing regulations for streams are generally in accordance with those of the surrounding area waters of the State of Washington. Fishing for bull trout and Chinook salmon, both Federally listed threatened species in the park, is prohibited.

Portions of the Puyallup area occur within Mount Rainier National Park. This area provides spawning and rearing habitat for bull trout and protects some of the bull trout habitat in Washington. Mount Rainier National Park staff are undertaking aquatic habitat monitoring, inventories of fish populations

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[259] U.S. Fish and Wildlife Service, 2004, *Draft Recovery Plan for the Coastal-Puget Sound Distinct Population Segment of Bull Trout (Salvelinus confluentus),* "Volume II (of II): Olympic Peninsula Management Unit," Portland, Oregon.

[260] NEA GIS analysis.

[261] GORP, "Mt. Rainier National Park: Fishing and Boating," http://gorp.away.com/gorp/resource/us_national_park/wa/fis_mrnp.htm, accessed June 10, 2004.

throughout unsurveyed watersheds within the park, and they are inventorying and replacing or modifying road culverts that will assist bull trout recovery in Puget Sound.[262]

3.9.1.4 Olympic National Forest

Olympic National Forest (632,300 acres) is located on the Olympic Peninsula with the Pacific Ocean to the west, the Strait of Juan de Fuca to the north and Puget Sound to the east. The Forest surrounds much of Olympic National Park. Outdoor recreation opportunities at Olympic National Park include camping, picnicking, hiking, swimming, horseback riding, fishing, hunting, auto touring, backpacking, boating, and watching wildlife. There are 20 campgrounds for a combined 530 camp units, as well as cabins and other special camping units. There are 266 miles of trails, 87 of which are in designated wilderness areas.[263]

Approximately 482,000 acres of watershed within the Forest are included in the proposed bull trout CHD.[264] Threatened or endangered fish species with applied regulations in the Forest include bull trout, Hood Canal summer chum salmon, and Puget Sound Chinook salmon.[265]

There are five large lowland lakes on the Olympic Peninsula, each over 1,000 acres in size. Lake Quinault, Wynoochee Lake, and Lake Cushman are in or adjacent to the Olympic National Forest. Camping, picnicking, swimming, fishing, and boating opportunities are available at each lake. A State fishing license is required for fishing except at Lake Quinault, where a Quinault Tribal fishing license is required. All five lakes have boat ramp facilities available.[266]

3.9.1.5 Mount Baker-Snoqualmie National Forest

The Mount Baker-Snoqualmie National Forest is located in Washington State and extends more than 140 miles along the western slopes of the Cascade Mountains from the Canadian border to the northern boundary of Mount Rainier National Park. The Forest covers portions of Whatcom, Skagit, Snohomish,

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262 U.S. Fish and Wildlife Service, 2004, *Draft Recovery Plan for the Coastal-Puget Sound Distinct Population Segment of Bull Trout (Salvelinus confluentus),* "Volume I (of II): Puget Sound Management Unit," Portland, Oregon.

263 U.S. Forest Service, "Olympic National Forest: Recreation Facts," http://www.fs.fed.us/r6/olympic/recreation/info/facts/index.html, accessed June 4, 2004.

264 NEA GIS analysis.

265 U.S. Forest Service, November 2003 (last updated), "Olympic National Forest Facts," http://www.fs.fed.us/r6/olympic/aboutonf/onf_facts.htm, accessed June 4, 2004.

266 U.S. Forest Service, "Olympic National Forest: Recreation Diversity," http://www.fs.fed.us/r6/olympic/recreation/info/diversity/index.html, accessed June 4, 2004.

King, and Pierce counties and is one of the most visited national forests in the country.[267] Approximately 929,000 acres of watershed within the Forest are included in the proposed bull trout CHD.[268]

The Forest offers a variety of recreation sites including more than 50 campgrounds, picnic areas, and scenic viewpoints, as well as water sport and snowplay areas. The Forest manages seven downhill ski areas, four at Snoqualmie Pass and one each at Crystal Mountain, Stevens Pass, and Mount Baker. There are over 1,500 miles of hiking trails including portions of the Pacific Crest National Scenic Trail. The Forest also provides ample opportunities for hunting, fishing, skiing, snowmobiling, snowshoeing, river rafting, bird watching, berry picking, picnicking, and sightseeing.[269]

The streams, rivers, and lakes of the Mount Baker-Snoqualmie National Forest support dozens of species of fish, many of which are classified as game fish by the states of Oregon and Washington. Northwest game fish include predominately native coldwater fish species, such as Pacific salmon, trout, and char (including bull trout), as well as warmwater fish, largely introduced from midwest and eastern states.[270]

3.9.2 Recreation Visitation

This section features information characterizing the state of recreation visitation in the national parks and forests before and after the 1998 bull trout listing.

3.9.2.1 North Cascades, Olympic, Mount Rainier National Parks (NPS)

A national park visit is defined as the entry of any person, except NPS personnel, onto lands or waters administered by the NPS. A visit may occur as a recreation visit or a non-recreation visit. A same day reentry, negligible transit, and an entry to a detached portion of the same park on the same day are considered to be a single visit. Adjustments are made insofar as practicable to prevent duplicate counting, so that one entrance per individual per day is counted as one visit.[271]

Table 60 displays recreation use statistics for the North Cascades, Olympic, and Mount Rainier National Parks from 1993 to 2003. Recreation use at the North Cascades National Park is much lower than that of the other national parks in the region, ranging from a low of 19,323 in 1994 to a high of 65,984 in 1995

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267 U.S. Forest Service, March 31, 2004 (last updated), “Mt. Baker-Snoqualmie National Forest: About Us,” http://www.fs.fed.us/r6/mbs/about/, accessed June 4, 2004.

268 NEA GIS analysis.

269 Ibid.

270 U.S. Forest Service, “Mt. Baker-Snoqualmie National Forest: Fish Resources,” http://www.fs.fed.us/r6/fishing/forests/fishresources/mtbsno_index.html, accessed June 4, 2004.

271 National Park Service, August 6, 2001, “Director’s Order – 82, Public Use Data Collecting and Reporting Program.”

over the last ten years. Recreation use is highest at Olympic National Park compared to other national parks in the region, ranging from 2.68 million in 1993 to 3.85 million in 1997. Over the last ten years, recreation use at Mount Rainier National Park ranged from a low of 1.26 million in 2003 to 1.44 million in 1995.

Table 60
North Cascades, Olympic, and Mount Rainier National Parks Recreation Use Data

Year	North Cascades National Park		Olympic National Park		Mt. Rainier National Park	
	Recreation Use	Change from Prior Year	Recreation Use	Change from Prior Year	Recreation Use	Change from Prior Year
1993	21,378	5.3%	2,679,598	11.6%	1,365,213	10.3%
1994	19,323	-9.6%	3,381,573	26.2%	1,426,244	4.5%
1995	65,984	241.5%	3,658,615	8.2%	1,438,227	0.8%
1996	27,910	-57.7%	3,348,723	-8.5%	1,338,961	-6.9%
1997	27,203	-2.5%	3,846,709	14.9%	1,315,773	-1.7%
1998	32,753	20.4%	3,577,007	-7.0%	1,353,793	2.9%
1999	21,488	-34.4%	3,364,266	-5.9%	1,291,397	-4.6%
2000	25,704	19.6%	3,327,722	-1.1%	1,344,833	4.1%
2001	27,739	7.9%	3,416,069	2.7%	1,301,103	-3.3%
2002	20,690	-25.4%	3,691,310	8.1%	1,310,390	0.7%
2003	20,724	0.2%	3,225,327	-12.6%	1,262,351	-3.7%

Source: NPS, Public Use Statistics Office, "NPS Visitation Database Reports, Park by Year 1904-2003," http://www2.nature.nps.gov/stats/, accessed August 31, 2004.

3.9.2.2 Olympic and Mount Baker-Snoqualmie National Forests (USFS)

Survey data for the Olympic National Forest provide information on the relative proportions of visitors engaged in various outdoor recreation activities. Of the 1,118 people who were surveyed as part of the Olympic National Forest NVUM 2000 use assessment, 972 indicated their primary reason for visiting the forest was recreation (87 percent). Of those, 106 indicated they fished (11 percent) and 48 stated angling was their primary recreation activity (5 percent). It is assumed that angling for bull trout is a small percent of the 48 who indicated fishing was their primary recreation activity.

Of the 1,314 people who were surveyed as part of the Mount Baker-Snoqualmie National Forest NVUM 2000 use assessment, 1,130 indicated their primary reason for visiting the forest was recreation (86 percent). Of the 1,130 visitors whose primary reason for visitation was recreation, 22 indicated they fished (2 percent) and 22 stated angling was their primary recreation activity (2 percent). Based on conversations with national forest staff and WDFW, angling for bull trout accounts for a small portion of those who indicated fishing was their primary recreation activity.

3.9.3 Data Sources

A literature review was conducted to: 1) characterize the existing recreation setting in the study area; and 2) understand characteristics of recreation opportunities and use in the western Washington area. Information was collected from internet searches, interviews with agency staff, and published literature. Personnel from the USFS, NPS, and WDFW provided existing and estimated recreation use levels.

3.9.4 Results and Analysis

In general there are many desirable types of sport fish available in national parks and forests and the 1998 bull trout listing has not had a significant effect on recreation use or access. The bull trout listing had virtually no effect on recreation in the western Washington area, partly because WDFW protections measures were in place prior to the 1998 listing. The magnitude of those effects is unknown,[272] but is assumed to be small. Impacts to specific recreational areas are summarized below.

At North Cascades National Park, there are portions in the Upper Skagit River watershed and Ross Lake that are part of bull trout critical habitat. The NPS has not restricted recreation access or use of these areas due to the 1998 bull trout listing. Within North Cascades National Park, the upper Skagit River watershed is one of the few bull trout critical habitat areas where bull trout angling is still permitted.[273]

The NPS does collect and store data on angling use, however, these data are not summarized and organized at this time.[274] Olympic National Park recreational access, or use of these areas associated with bull trout habitat has not been changed (restricted or limited) as a result of the 1998 bull trout listing.[275] However, the NPS had implemented a "no fishing'" restriction for bull trout in advance of the listing (based on WDFW protection measures). The number and proportion of visitors fishing for bull trout is probably very low, since many anglers in western Washington consider bull trout less desirable that are other sport fish available.

At Mount Rainier National Park, fishing is limited and does not attract many anglers. The bull trout listing has not had a noticeable impact to sport fishing and recreation use or access.[276]

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[272] Personal communication with Mark Downen, Washington Department of Fish and Wildlife, May 28, 2004; and personal communication with Bill Freymond, Washington Department of Fish and Wildlife, May 28, 2004.

[273] Personal communication with Reed Glesne, Biologist, North Cascades National Park, May 18, 2004.

[274] Personal communication with Sam Brenkman, Biologist, Olympic National Park, May 18, 2004.

[275] Ibid.

[276] Personal communication with National Park Service Staff, June 10, 2004.

At Olympic National Forest, fishing has not been affected by the bull trout listing; no measurable change in fishing use has been observed.

At Mount Baker-Snoqualmie National Forest, fishing has not been affected after the 1998 bull trout listing because there are several other sport fish species available and more favored by anglers.[277] The WDFW had several conservation activities in place prior to the 1998 listing and there was little if any effect from the actual listing by the Service. Staff at Mount Baker-Snoqualmie National Forest indicated that they have not communicated with any visitor who was upset because of bull trout protection activities.[278]

3.10 Effects on Utilities

This analysis considers utility projects that involve construction and repair in locations that can potentially impact bull trout and therefore require conservation activities. Utility projects generally include work related to pipelines and other utility lines (e.g., telephone) and associated outfall structures. Common activities include excavation, backfilling, and restoration of the work site. When these projects occur within or proximate to water bodies, they generally require a Section 404 CWA permit or a Section 10 River and Harbors Act permit from the USACE.

This analysis estimates the cost of conservation activities typically required by the Service for utility projects. Common conservation activities for pipeline projects include erosion control, bank stabilization, and excavation and backfill requirements.[279] Construction of and repair to utility outfall structures include in-water work restrictions, fish passage and salvage, site restoration, and monitoring. In total, 175 utility projects have been consulted on since the bull trout listing, or approximately 32 per year.[280]

3.10.1 Data Sources

The number and location of past utility projects that resulted in bull trout consultations were obtained from a database provided by the Seattle branch of USACE.[281] These data were mapped using GIS software in order to identify the watershed in which each project occurred. The cost of conservation

277 Personal communication with Larry Donovan, Mt. Baker-Snoqualmie National Forest, June 10, 2004.

278 Ibid.

279 Based on review of biological assessments and biological opinions resulting from section 7 consultations with USACE on utility projects.

280 U.S. Army Corps of Engineers - Seattle District, Regulatory Analysis and Management (RAMS) Database of Bull Trout Consultations (1998-2004), personal communication with Michelle Walker, U.S. Army Corps of Engineers, May 14, 2004.

281 Ibid.

activities associated with a typical utility consultation is based on interviews with affected parties and the USACE.

3.10.2 Cost Estimation Methodology

The costs per watershed associated with utility project consultations is estimated by multiplying the number of historically occurring utility project consultations per watershed by the average cost of conservation activities for a typical consultation. The following outlines the steps for the analysis:

1. Identify the number and location (i.e., watershed) of historically occurring section 7 consultations between the Service and the USACE on utility projects. The analysis relies on the USACE's Regulatory Analysis and Management System (RAMS) database, which catalogs the latitude and longitude coordinates for historic consultations on various activities permitted by the agency. For the purpose of utility consultations, only bull trout consultations since 1998 related to the following worktypes are included: "utility," "outfall structure," and "aerial crossing."

2. To estimate future utility projects within proposed bull trout critical habitat, this analysis calculates the total number of utility projects per watershed since 1998. There have been 175 historic consultations on utility projects since bull trout listing, but only 139 of these have occurred in watersheds included in the proposed designation.

3. Because there is no data source available to indicate where and when future utility projects are likely to occur, this analysis relies on data provided by the USACE on historic consultations. A review of past utility projects that were consulted on for bull trout indicates that the projects tend to occur with a similar frequency within a region or watershed. That is, watersheds (HUCs) with a large number of utility projects in one year tend to experience a large number of utility projects in subsequent years. For the prospective analysis, this study assumes 23 future annual utility projects.[282] For the retrospective analysis, the study assesses the cost of all 29 annual utility consultations, regardless of watershed.[283]

4. Average costs associated with pipeline and outfall projects were obtained from interviews with USACE staff and public utility representatives. Economic impacts associated with utility projects generally include mitigation activities associated with pipeline replacements (e.g., tree planting, riparian restoration), timing restrictions, water quality monitoring, and various techniques to avoid/minimize impact to water quality (e.g., directional drilling). To develop annual costs this analysis assumes a project life of 20 years. The costs in Table 61 reflect the variation in utility projects consulted on by USACE and provide average costs for a typical project.

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282 139 historic utility projects have occurred in the watersheds proposed for critical habitat over the last 6 years of USACE data.

283 175 historic utility projects over the last 6 years of USACE data.

Table 61
Summary of Per Project Utility Costs

Project Type	Expected Project Costs[c/]	Annual Costs[d/]
Pipelines[a/]	$116,250	$5,812
Outfall Structures[b/]	$100,000	$5,000
Average Costs	$108,125	$5,406

[a/] Conservation activities associated with pipelines include mitigation for pipeline replacements (e.g., tree planting, riparian restoration), and various techniques to avoid/minimize impact to water quality (e.g., directional drilling).

[b/] Conservation activities associated with outfall structures include construction techniques to avoid sedimentation, timing restrictions, and water quality monitoring.

[c/] Costs are based on personal communication with affected parties and USACE (see step 3 in the analysis above).

[d/] Annual costs were estimated assuming a project life of 20 years.

5. To estimate total annual costs, the annual number of utility projects in each watershed was multiplied by the annual costs provided in Table 61 (see Table 62).

Table 62
Calculation of Utility Costs

Category	Total Utility Projects	Total Years of Data	Annual Utility Projects	Per Project Costs	Total Annual Costs
Utility Projects – Prospective (Annual)	n/a	6	23	$5,406	$ 125,000
Utility Projects - Retrospective (1998 - 2004)	175	6	29	$5,406	$1,025,000

6. For the prospective analysis, economic impacts occurring in "nearshore marine habitat HUCs" are included because most USACE-permitted activities occur near marine shorelines.

7. To estimate total prospective costs for these activities, calculate the total present value of annual costs over the 20-year period of the analysis, using a three and seven percent discount rate.

8. Total retrospective costs were estimated by multiplying annual retrospective costs (Table 62) by the number of years since the bull trout was listed (6.5 years).

Table 63 provides a summary of the retrospective and prospective costs associated with utility projects in the proposed Coastal-Puget Sound CHD. Total retrospective costs are estimated to be $1,025,000. Prospective costs are estimated to be $125,000 per year.

Table 63
Potential Economic Impacts on Utility Projects Associated with Co-Extensive Salmon and Bull Trout Conservation Activities

Coastal-Puget Sound	Retrospective (Total)	Prospective (Total)		Prospective (Annualized)
		3%	7%	
Proposed Critical Habitat	$1,025,000	$1,863,000	$1,327,000	$125,000
Proposed for Exclusion	$0	$0	$0	$0
Excluded	$0	$0	$0	$0

3.10.3 Assumptions and Uncertainties

Table 64
Assumptions and Uncertainties

Assumption	Direction of Bias
Past costs, location, and frequency of USACE permits provide an accurate indicator of future permit activity and costs	+/-
To account for the costs of conservation activities that are for the benefit of bull trout and listed salmon species, the analysis attributes the costs of the fish-related conservation activities co-extensively to both species.	+
Conservation activities have not reduced overall utility line construction activities within a region	+/-
Data are not available to differentiate between the sizes of individual projects	+/-

+: This assumption is likely to produce an upward bias in cost estimates.

-: This assumption is likely to produce a downward bias in cost estimates.

+/-: No direction of bias can be determined.

3.11 Effects on Dredging Activities

USACE permits are required for dredging activities due to Section 404 CWA or Section 10 River and Harbors Act. Dredging activities can impact bull trout by increasing turbidity, which can interfere with fish movement. In addition, dredging can result in entrainment of bull trout.

This section estimates the cost of conservation activities typically required by the Service for dredging projects conducted by USACE. Common conservation activities for dredging projects include sediment disposal requirements, screens on suction devices, avoidance of important habitat areas, and period of work restrictions. Dredging activities in waterways where bull trout may be present are generally restricted to the period between July 16 and February 14. However, waterways with additional listed fish species can further reduce the work window. In addition, dredging activities in many rivers are not allowed during the summer months due to dissolved oxygen problems associated with low flow conditions.[284] Approximately 155 dredging projects have required consultations since bull trout were listed, or approximately 28 per year.[285]

3.11.1 Data Sources

The number and location of past dredging projects that included bull trout consultations were obtained from a database provided by the Seattle Branch of the USACE.[286] These data were mapped using GIS software in order to identify the watershed that each project occurred in. The cost of conservation activities associated with a typical dredging consultation is based on a variety of sources including interviews with project proponents and published material.

3.11.2 Cost Estimation Methodology

The costs per watershed associated with dredging projects is estimated by multiplying the number of dredging projects per watershed by the average cost of typical conservation activities. The following provides an outline of the steps for the analysis:

1. Identify the number and location (i.e., watershed) of historically occurring section 7 consultations between the Service and the USACE on dredging projects. The analysis relies on the USACE's Regulatory Analysis and Management System (RAMS) database, which catalogs the latitude and longitude coordinates for historic consultations on various activities permitting by the Agency. For the purpose of dredging consultations, only bull trout consultations since 1998 related to the following worktypes are included: "excavation," "dredging," and "disposal of dredged material."[287]

2. To estimate future dredging projects within bull trout proposed critical habitat, this analysis calculates the total number of projects per watershed since 1998. There have been 155 historic consultations on dredging projects since bull trout listing, but only 139 of these have occurred in watersheds included in the proposed designation.

3. Because there is no data source available to indicate where and when future dredging projects are likely to occur, this analysis relies on data provided by the USACE on historic consultations. A

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[284] Personal communication with George Hart, Biologist, U.S. Army Corps of Engineers – Seattle District, June 2004.

[285] U.S. Army Corps of Engineers - Seattle District, Regulatory Analysis and Management (RAMS) Database of Bull Trout Consultations (1998-2004), personal communication with Michelle Walker, U.S. Army Corps of Engineers, May 14, 2004.

[286] Ibid.

[287] Our estimate of dredging projects is based on the historical record of dredging consultations since 1998 and therefore may overestimate costs associated with projects that occur deeper than –10 meters Mean Lower Low Water (MLLW).

review of past dredging projects that were consulted on for bull trout indicates that the projects tend to occur with a similar frequency within a region or watershed. That is, watersheds (HUCs) with a large number of dredging projects in one year tend to experience a large number of dredging projects in subsequent years. For the prospective analysis, this study assumes 23 future annual dredging projects.[288] For the retrospective analysis, the study assesses the cost of all 26 annual dredging consultations, regardless of watershed.[289]

4. Average costs associated with dredging projects were obtained from a variety of sources including interviews with project proponents and published material. Table 65 provides the average costs assigned to a typical dredging project for the purpose of this analysis. Costs were estimated for work preparation and monitoring as well as for work window restrictions. In some cases, there may be incremental costs associated with sediment disposal requirements. However, no cost information was available for this analysis. To develop annual costs this analysis assumes a project life of 20 years. The costs in Table 65 reflect the variation in dredging projects consulted on by USACE and provide average costs for a typical project.

Table 65
Summary of Per Project Dredging Costs

Project Type	Expected Project Costs	Annual Costs[a/]
Preparation and Monitoring	$15,000	$1,500
Work Windows	$391,400	$39,140
Sediment Disposal	Not Assessed	Not Assessed
Average Costs Assessed	$406,400	$40,640

[a/] Annual costs were estimated assuming a project life of 10 years.

Source: Personal communication with George Hart, USACE – Seattle, June 2004; and USACE, December 1998, "Economic Impacts of Environmental Windows Associated with Dredging Operations," Technical Note DOER-E3.

5. To estimate total annual costs, the annual number of dredging projects in each watershed was multiplied by the annual costs provided in Table 65.

6. For the prospective analysis, economic impacts occurring in "nearshore marine habitat HUCs" are included because most USACE-permitted activities occur near marine shorelines.

[288] 139 historic utility projects have occurred in the watersheds proposed for critical habitat over the last six years of USACE data.

[289] 155 historic utility projects over the last six years of USACE data.

Table 66
Calculation of Dredging Costs

Category	Total Dredging Projects	Total Years of Data	Annual Dredging Projects	Per Project Costs	Total Annual Costs
Dredging Projects – Prospective	n/a	6	23	$40,640	$941,500
Dredging Projects - Retrospective	155	6	25	$40,640	$6,824,000

7. To estimate total prospective costs for these activities, calculate the total present value of annual costs over the 20-year period of the analysis, using a three and seven percent discount rate.

8. Total retrospective costs were estimated by multiplying annual retrospective costs (Table 65) by the number of years since the bull trout was listed (6.5 years).

Table 67 provides a summary of the retrospective and prospective costs associated with dredging projects in Coastal-Puget Sound. Total retrospective costs are estimated to be $6.8 million. Prospective costs are estimated to be approximately $941,000 per year. Total prospective costs are $10.0 million using a seven percent discount rate.

Table 67
Potential Economic Impacts on Dredging Projects Associated with Co-Extensive Salmon and Bull Trout Conservation Activities

Coastal-Puget Sound	Retrospective (Total)	Prospective (Total)		Prospective (Annualized)
		3%	7%	
Proposed Critical Habitat	$6,824,000	$14,007,000	$9,974,000	$941,000
Proposed for Exclusion	$0	$0	$0	$0
Excluded	$0	$0	$0	$0

3.11.3 Assumptions and Uncertainties

Table 68
Assumptions and Uncertainties

Assumption	Direction of Bias
Past costs, location, and frequency of USACE permits provide an accurate indicator of future permit activity and costs	+/-
To account for the costs of conservation activities that are for the benefit of bull trout and listed salmon species, the analysis attributes the costs of the fish-related conservation activities co-extensively to both species.	+

Assumption	Direction of Bias
Dredging methods and costs remain constant throughout the analysis period	+
Conservation activities have not reduced overall dredging activities within a region	+/-
Data are not available to differentiate between the sizes of individual projects	+/-

+: This assumption is likely to produce an upward bias in cost estimates.

-: This assumption is likely to produce a downward bias in cost estimates.

+/-: No direction of bias can be determined.

3.12 EFFECTS ON INSTREAM ACTIVITIES

In addition to dredging and utility projects, USACE permits are required for a variety of other activities that affect waterways. These projects include construction and repair of piers, boat ramps, pilings, as well as bank stabilization and fill activities, among others. In this section, these projects are generally referred to as "instream" activities. This analysis considers instream projects that have required section 7 consultations for bull trout due to Section 404 CWA or Section 10 River and Harbors Act permitting with the USACE.

Instream activities can impact bull trout by increasing turbidity, which can interfere with fish movement. In-water structures such as piling and pier installation can also result in a loss of bull trout habitat and impact available food sources. In addition, there is the potential to harm bull trout during construction. Consequently, project proponents are required to follow conservation activities that are designed to minimize the potential harm both during and following instream activities.

This section estimates the cost of conservation activities typically required by the Service for instream projects. Common conservation activities for instream projects include habitat restoration and improvements, hazardous spill prevention, bubble curtains, and period of work restrictions. Instream projects represent the most commonly consulted on activity for bull trout. Approximately 3,300 individual instream projects have required consultation since the bull trout listing, or approximately 608 projects per year. Many of these projects are covered by programmatic consultations or under a single large project rather than independent consultations.

3.12.1 DATA SOURCES

The number and location of past instream projects that included bull trout consultations were obtained from a database provided by the Seattle Branch of the USACE.[290] These data were mapped using GIS software in order to identify the watershed that each project occurred in. The cost of typical conservation

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[290] Ibid.

activities associated with instream activities were obtained from a variety of sources including interviews with project proponents and published material.

3.12.2 Cost Estimation Methodology

The cost per watershed associated with instream projects is estimated by multiplying the number of projects per watershed by the average cost of typical conservation activities. The following outlines the steps for the analysis:

1. Identify the number and location (i.e., watershed) of historically occurring section 7 consultations between the Service and the USACE on various instream projects. The analysis relies on the USACE's RAMS database, which catalogs the latitude and longitude coordinates for historic consultations on various activities permitting by the agency. For the purpose of instream consultations, bull trout consultations since 1998 related to the following categories of worktypes are included: bank stabilization, ferry terminal, marina, boat launch, hatchery, jetty, etc.[291]

2. To estimate future instream projects within bull trout proposed critical habitat, this analysis calculates the total number of projects per watershed since 1998. There have been 4,966 historic consultations on instream projects since bull trout listing, but only 3,953 of these have occurred in watersheds included in the proposed designation.

3. Because there is no data source available to indicate where and when future instream projects are likely to occur, this analysis relies on data provided by the USACE on historic consultations. A review of past projects that were consulted on for bull trout indicates that the projects tend to occur with a similar frequency within a region or watershed. That is, watersheds (HUCs) with a large number of instream projects in one year tend to experience a large number of instream projects in subsequent years. For the prospective analysis, this study assumes 659 future annual instream projects.[292] For the retrospective analysis, the study assesses the cost of all 828 annual instream consultations, regardless of watershed.[293]

4. Average costs associated with instream projects were obtained from a variety of sources including interviews with project proponents and published material. Table 65 above provides the average costs assigned to a typical project for the purpose of this analysis. Costs were estimated for common

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[291] U.S. Army Corps of Engineers's RAMS database includes over 55 categories identified as relevant to typical instream activities. This excludes certain activities already captured elsewhere in the analysis (e.g., transportation, residential/commercial development, dam projects, etc.). Here, samples of the types of activities from major categories are provided.

[292] 3,953 historic instream projects have occurred in the watersheds proposed for critical habitat over the last six years of USACE data.

[293] 4,966 historic utility projects over the last six years of USACE data.

conservation activities for instream projects including habitat restoration and improvements, hazardous spill prevention, bubble curtains, and period of work restrictions. The specific activities for which costs are estimated include BMPs that may be required in the absence of bull trout; however, because these conservation activities provide specific benefits to bull trout, they are relevant to this economic analysis. To develop annual costs this analysis assumes a project life of 20 years. The costs in Table 69 reflect the variation in dredging projects consulted on by USACE and provide average costs for a typical project.

Table 69
Summary of Per Project Instream Costs

Project Type	Expected Project Costs	Annual Costs[a/]
Boat Dock Construction	$25,000	$1,250
Boat Launch Construction	$11,200	$560
Bank Stabilization	$34,050 to $84,400	$1,703 to $4,220
Average Costs Assessed	$54,500	$5,450

[a/] Annual costs were estimated assuming a project life of 20 years.

5. To estimate total prospective annual costs (see Table 70), the annual number of instream projects in each watershed was multiplied by the annual costs provided in Table 69.

6. For the prospective analysis, adjust economic effects occurring in "nearshore marine habitat HUCs" by dividing costs by two to account for only those instream activities that occur in marine environments (see Section 2.2.1).

Table 70
Calculation of Instream Costs

Category	Total Number of Instream Projects	Total Years of Data	Annual Instream Projects	Per Project Costs	Total Annual Costs	Total Costs Attributable to Bull Trout[a/]
Instream Projects - Prospective	n/a	6	659	$5,450	$3,591,000	$3,349,000
Instream Projects - Retrospective	4,966	6	828	$5,450	$29,320,000	$27,753,000

[a/] Total costs account the removal of costs associated with "nearshore marine habitat HUCs."

7. To estimate total prospective costs for these activities, calculate the total present value of annual costs over the 20-year period of the analysis, using a three and seven percent discount rate.

8. Total retrospective costs were estimated by multiplying annual retrospective costs (Table 70) by the number of years since the bull trout was listed (6.5 years).

Table 71 provides a summary of the retrospective and prospective costs associated with instream projects in the proposed Coastal-Puget Sound CHD. Total retrospective costs are estimated to be $27.8 million. Prospective costs are estimated to be $3.3 million per year.

Table 71
Potential Economic Impacts on Instream Projects Associated with Co-Extensive Salmon and Bull Trout Conservation Activities

Coastal-Puget Sound	Retrospective (Total)	Prospective (Total)		Prospective (Annualized)
		3%	7%	
Proposed Critical Habitat	$27,753,000	$49,832,000	$35,484,000	$3,349,000
Proposed for Exclusion	$0	$0	$0	$0
Excluded	$0	$0	$0	$0

3.12.3 ASSUMPTIONS AND UNCERTAINTIES

Table 72
Assumptions and Uncertainties

Assumption	Direction of Bias
Past costs, location, and frequency of USACE permits provide an accurate indicator of future permit activity and costs	+/-
To account for the costs of conservation activities that are for the benefit of bull trout and listed salmon species, the analysis attributes the costs of the fish-related conservation activities co-extensively to both species.	+
Conservation activities have not reduced overall instream construction activities within a region	+/-
Data are not available to differentiate between the sizes of individual projects	+/-

+: This assumption is likely to produce an upward bias in cost estimates.

-: This assumption is likely to produce a downward bias in cost estimates.

+/-: No direction of bias can be determined.

3.13 EFFECTS ON CULVERT REPLACEMENT

This analysis examines the potential economic impact resulting from culvert replacement and fish barrier removal, including both past replacements (1998 to 2004) and expected future replacements (2005 to 2024). These costs are attributable to conservation measures designed to improve habitat or recovery for the bull trout and therefore are relevant for the purpose of this analysis. Many of the existing road culverts present barriers to fish migration, including both older culverts that are at the end of their serviceable life as well as newer culverts replaced within the last 10 to 20 years.[294] To allow for fish passage, some culverts are replaced with newer and larger culverts or, in some cases, are replaced with bridges. In other cases, existing culverts are simply reconditioned to extend the life of the culvert without necessarily providing for fish passage.[295] The WDFW has established culvert replacement standards that ensure successful fish passage.[296] Roads that currently support culverts and other fish barriers include USFS roads, private single-lane roads, county roads, State roads, and Federal highways.

The economic impacts vary depending on the height of the existing culvert above the road, the stream width, engineering standards, and whether the culvert has reached the end of its serviceable life. For example, the design standards for certain county roads require load capacities sufficient to support fire trucks and other emergency vehicles. High volume county and State roads may require even higher engineering costs associated with culvert replacement and some WDOT roads (including highways) may require the construction of a bridge to provide adequate fish passage, resulting in the highest economic impact. In addition, some culverts have reached the end of their serviceable life and would have been replaced regardless of concerns about endangered species. In these cases, the economic impacts of this bull trout conservation measure would only include the incremental costs associated with providing a fish barrier-free culvert replacement.

This analysis estimates an average expected cost of culvert repair or replacement by considering a range of historic costs. The engineering and construction costs vary depending on roadway attributes and range from $56,000 for simple one-lane roads up to $566,000 for major roads/highways. Costs also include consideration of baseline culvert re-conditioning which is likely to take place in the absence of WDFW culvert replacement requirements. Past culvert replacement costs rely exclusively on the costs of major roads/highway only, based on WDOT's data on culvert replacement/fish barrier removal projects from 1998 to 2004.

3.13.1 DATA SOURCES

To estimate future culvert replacement costs, this analysis relies on the WDFW's Culvert Database, a statewide spatial inventory of over 17,000 culverts on private, State, and Federal lands. Within the bull

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294 Personal communication with Richard Geiger, Engineer, Mason County Conservation District, June 17, 2004; personal communication with Tom Creegan, Engineer, King County Roads Department, August 3, 2004; and personal communication with Jacque Dean, Engineer, Kitsap County Public Works Department, August 3, 2004.

295 Personal communication with Richard Geiger, Engineer, Mason County Conservation District, August 3, 2004.

296 Washington Department of Fish and Wildlife, May 2003, "Design of Road Culverts for Fish Passage – 2003," http://wdfw.wa.gov/hab/engineer/cm/culvert_manual_final.pdf.

trout study area, this analysis identifies approximately 233 culverts for which removal or replacement could lead to future habitat gains.[297]

It is important to note that the WDFW database has inventoried approximately 15 percent of all statewide culverts. WDFW estimates there are approximately 33,000 culverts that prevent passage to at least 200 meters of habitat. Their database contains spatial inventory on approximately 6,000 culverts that prevent fish passage.[298] Based on a visual analysis which indicates that surveyed culverts appear evenly distributed across the study area (i.e., there does not appear to be a bias toward either surveyed or non-surveyed culverts), this analysis adjusts the total number of culverts upward to reflect the total number likely found in the State.

To estimate past culvert replacement costs, this analysis relies on the WDOT spatial data on historic road construction projects involving culvert replacement and fish passage improvement. Approximately 67 fish barrier removal projects since 1998 were identified. These projects were on WDOT-owned roads only and, by excluding local and county road projects, may understate historic costs.

3.13.2 Cost Estimation Methodology

The estimate of total annual costs per HUC over the future 20-year perspective period of analysis and the six-year retrospective period of analysis is derived in the following sections.

3.13.2.1 Cost of Future Culvert Replacements

1. Estimate the type and number of culverts per watershed that currently act as fish barriers and will provide expected habitat improvements upon removal. Table 73 below summarizes data from the WDFW Fish Passage and Diversion Screening Inventory database for culverts found within the Bull Trout affected area. Only those culverts that are identified as likely to provide "limited habitat gain (<200 m)" or "sufficient habitat gain to require repair" are included. This analysis excludes culverts found on HCP and USFS land, since replacement costs are considered separately under that section (Section 3.4).

2. Adjust the total number of culverts affecting bull trout upward to reflect the total number likely found in the State, based on a visual analysis indicating that surveyed culverts appear evenly distributed across the study area (i.e., there does not appear to be a bias toward either surveyed or non-surveyed culverts). Discussions with WDFW indicate that the most current version of the

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297 Specifically, this analysis includes economic impacts associated with culverts identified as "significant future habitat gains likely" and "limited habitat gains likely."

298 Personal communication with Brian Benson, Information Technology Application Specialist, Washington Department of Fish and Wildlife, June 22, 2004.

survey only covers 15 percent of the total culverts in the State.[299] Therefore, this analysis divides the per watershed estimate of the number of culverts by 15. This analysis assumes the ratio of total culverts to culverts affecting bull trout habitat remains constant across the State (see Table 73).

Table 73
Summary of Culverts Impacting Bull Trout Habitat

Categories Collected in WDFW Database (2004)[a/]	Culverts
Estimated culverts statewide	17,749
Estimated culverts in bull trout affected area	12,827
Culverts that block bull trout passage	297
Limited habitat gain	*35*
Habitat gain unknown	*63*
Sufficient habitat gain to require repair	*198*
Total Culverts Identified in Database	233
Total Culverts Impacting Bull Trout Habitat[b/]	1,553

[a/] Fish passage database information as of June 2004.
[b/] Total culverts impacting bull trout habitat based on adjustment factor to reflect actual number of culverts (Step 2).

3. This analysis assumes that all 1,553 fish barrier culverts that provide potential for improved fish passage will be replaced at some point over the 20-year period of this analysis and assumes an equal likelihood of that occurring in any given year. Because specific information is not available on when an individual culvert is likely to be replaced, all culverts are assumed to be half-way through their life expectancy of 50 years.

4. This analysis assumes that 50 percent of the culverts affecting bull trout are at the end of their serviceable life and need to be replaced independent of bull trout concerns. For these 50 percent, this analysis applies an incremental cost associated with installing a fish passage culvert over a simple culvert reconditioning that does not provide for fish passage. For the remaining 50 percent, this analysis assumes culverts would not have been replaced "but for" endangered species concerns and applies the full cost of culvert replacement.[300] Incremental costs are based on the assumption that small culvert types (e.g., USFS single lane roads) can be reconditioned "in

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299 Ibid.

300 Assumption of 50 percent is based on discussion with several county public works departments in the affected area. Engineers estimated that of the culverts that impact fish passage and prevent access to otherwise healthy fish habitat in their county, approximately half of the replacements were on structures that were due for removal/replacement independent of fish passage concerns.

situ" for 10 percent of the cost of complete replacement and medium and large size culverts can be reconditioned "in situ" for 50 percent of the cost of complete replacement.[301]

5. This analysis assumes the project life of culvert replacement is 50 years.[302]

6. Total and incremental per project costs of culvert replacement and reconditioning are estimated in 2004 dollars based on a range of costs and a variety of roadway attributes. The weighted average of total and incremental costs is based on the 50 percent assumption in Step 3 above (Table 74).

Table 74
Calculation of Per Project Culvert Costs

Road Type	Cost Category	Expected Total Costs[a/]	Expected Incremental Costs[b/]	Weighted Average of Costs[c/]
USFS Road (one-lane)	Small	$56,000	$51,188	$53,594
Minor Road (two-lane)	Medium	$138,000	$69,063	$103,531
Major Road Culvert Replacement/Bridge Construction	Large	$566,000	$283,000	$424,500

[a/] The expected average cost accounts for a range of costs depending on a variety of criteria (e.g., width of stream, height of road surface above stream, roadway classification, etc.). Major road culvert replacement/bridge replacement includes a range of $325,000 up to $1.2 million for bridge construction.

[b/] Expected incremental costs associated with fish passage culverts is based on the cost difference between complete culvert replacement providing for fish passage (i.e., removing soil, replacing existing culvert, disrupting traffic flow) and basic culvert reconditioning that does not provide for fish passage. See step 4 above.

[c/] Weighted average of costs is based on assumption that 50 percent of all culverts will incur the full cost of replacement and 50 percent will incur the incremental cost of replacement. See Step 3 above.

Sources: A Primer on Habitat Project Costs, Puget Sound Shared Strategy for Salmon Recovery, Spring 2003, http://www.sharedsalmonstrategy.org/files/PrimeronHabitatProjectCosts.pdf; WDOT Progress Performance Report for WDOT Fish Passage Inventory, April 2004, http://www.wsdot.wa.gov/environment/fishpass/docs/WSDOT2004.pdf; and personal communication with Richard Geiger, Engineer, Mason County Conservation District, June 17, 2004.

7. Weighted per project costs are assigned to each of the 236 culverts identified in the analysis. To assign cost categories, this analysis relies on the following decision rules:

   - Culverts owned by STATE and having MILEPOST are assigned LARGE (e.g., WDOT culverts)

   - Culverts owned by COUNTY or CITY are assigned MEDIUM

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[301] Personal communication with Richard Geiger, Mason County Conservation District Engineer, August 4, 2004.

[302] Personal communication with Richard Geiger, Mason County Conservation District Engineer, June 17, 2004.

- Culverts owned by PRIVATE or FEDERAL are assigned SMALL (incl. USFS)

- Culverts owned by UNKNOWN are assigned MEDIUM

8. Annual cost of culvert replacement for weighted cost categories (e.g., small, medium, large) are estimated by dividing per project costs by expected project life (e.g., 50 years) (see Table 75).

9. For the prospective analysis, economic effects occurring in "nearshore marine habitat HUCs" are excluded to reflect the fact that inland culvert replacement projects are unlikely to incur costs associated with the proposed designation.

10. Estimate the present value of future culvert replacement costs per watershed over the future 20-year time frame of the analysis using a three and seven percent discount rate.

Table 75
Annual Cost Calculation for Prospective Culvert Replacement

Culvert Type	Total No. of Culverts Affecting Bull Trout[a/]	Weighted Average Cost	Annual Weighted Average Cost[b/]	Expected Time of Replacement/ Re-conditioning (years from present)[c/]	Total Annual Costs
Small	500	$53,594	$1,072	25	$ 21,000
Medium	393	$103,531	$2,071		$ 33,000
Large	660	$424,500	$8,490		$ 224,000
Total	**1,553**				**$ 278,000**
Impacts Co-Extensive with Salmon and Bull Trout[d/]					**$263,000**

[a/] Estimated number of culverts affecting bull trout includes an adjustment to reflect the total number of culverts most likely found in the State (see Step 2). The ratio of total culverts to culverts affecting bull trout habitat is assumed to remain constant across the State.

[b/] Annual cost based on 50 year life of a culvert and seven percent discount rate where the likelihood of replacement occurring at any point during the 50 year period is evenly distributed (i.e., weighted average cost divided by 50 years).

[c/] Expected time of replacement based on a lack of information regarding culvert-specific life of service. This analysis assumes a midpoint in the expected level of service for any given culvert (25 years).

[d/] Total costs account for watersheds that are designated "nearshore marine habitat HUCs."

3.13.2.2 Cost of Past Culvert Replacements

1. The first step is to estimate the type and number of culverts per watershed removed or replaced by the WDOT since 1998. The analysis relies on GIS data provided by WDOT that describes road improvement project types. The following road projects types are included: CULVERT

ENHANCEMENT, CULVERT REHABILITATION, FISH PASSAGE BARRIER REMOVAL, REPLACE CULVERT AND FISH ENHANCEMENT, REPLACE EXISTING CULVERT, REMOVE FISH BARRIER, REMOVE MIGRATORY FISH BARRIER. It includes a total of 67 culvert replacement projects.

2. As noted above for the perspective analysis, this analysis assumes that 50 percent of the 67 culverts affecting bull trout were at the end of their serviceable life and needed to be replaced independent of bull trout concerns. For these 50 percent, an incremental cost associated with installing a fish passage culvert over a simple culvert reconditioning that does not provide for fish passage is applied. For the remaining 50 percent, assume culverts would not have been replaced "but for" ESA concerns and therefore apply the full cost of culvert replacement.[303] Incremental costs are based on the assumption that large size culverts can be reconditioned "in situ" for 50 percent of the cost of complete replacement.[304]

3. Total, incremental, and weighted per project cost of culvert replacement are estimated in 2003 dollars, based on costs category associated with culvert replacement on major State roads (e.g., large culvert replacements) (see Table 74).

4. Total present value of past culvert replacement costs per watershed since 1998 are estimated by multiplying weighted per project costs by the number of projects in each watershed.

Table 76
Annual Cost Calculation for Retrospective Culvert Replacement

Culvert Type	Total No. of Culverts Removed	Annual Weighted Costs	Number of Years[a/]	Total Costs 1998-2004	Total Annual Costs of Co-Extensive Conservation Activities
Large	67	$8,490	6.5	$3,697,000	$2,483,000

[a/] Number of years in the retrospective analysis is based on the time between the listing of the species in June 1998 through 2004.

303 50 percent assumption is based on discussion with several county public works departments in the affected area. Engineers estimated that of the culverts that impact fish passage and prevent access to otherwise healthy fish habitat in their county, approximately half of the replacements were on structures that were due for removal/replacement independent of fish passage concerns.

304 Personal communication with Richard Geiger, Engineer, Mason County Conservation District, August 4, 2004.

3.13.3 RESULTS

As shown in Table 77, potential economic impacts associated with culvert removal and/or replacement is approximately $263,000 annually, which represents less than one percent of the total economic effects of bull trout conservation activities.

Table 77
Potential Economic Impacts of Culvert Removal/Replacement Associated with Co-Extensive Salmon and Bull Trout Conservation Activities

Coastal-Puget Sound	Retrospective (Total)	Prospective (Total)		Prospective (Annualized)
		3%	7%	
Proposed Critical Habitat	$2,483,000	$3,920,000	$2,791,000	$263,000
Proposed for Exclusion	$0	$0	$0	$0
Excluded	$0	$0	$0	$0

Note: Total figures include activities that occur spatially within a 5th Field HUC, including those that occur just outside a HUC watershed but within a WRIA.

3.13.4 ASSUMPTIONS AND UNCERTAINTIES

Table 78
Assumptions and Uncertainties in the Analysis

Assumption	Direction of Bias
This analysis assumes the WDFW culvert database includes statewide coverage of culverts that prevent fish passage. In reality, the database covers about 15 percent of all fish barriers in the State. However, due to a lack of information on the geographic distribution of surveyed and yet-to-be-surveyed culverts, it is not possible to defensibly adjust total economic impacts to reflect the actual number of affected fish barrier culverts in the bull trout affected area.	-
This analysis assumes all past culvert projects are captured by the WDOT database of fish barrier removal projects. This database does not capture local/county road projects and therefore likely underestimates retrospective costs.	-
This analysis assumes all culverts identified as fish barriers will be replaced at some point over the 20-year period of the analysis. Because specific information is not available on when an individual culvert is likely to be replaced, all culverts are assumed to be half-way through their life expectancy of 50 years, or 25 years. This may overstate or understate impacts depending upon how rapidly these culverts are replaced.	+/-

+: This assumption is likely to produce an upward bias in cost estimates.

-: This assumption is likely to produce a downward bias in cost estimates.

+/-: No direction of bias can be determined.

3.14 EFFECTS ON NPDES-PERMITTED FACILITIES

This analysis examines the potential economic impact to NPDES-permitted major and minor facilities resulting from newly developed water quality standards criteria concerning temperature. EPA, the Service, and NOAA Fisheries recently authored guidance to states and tribes on the development of temperature criteria deemed protective of certain species, including salmonids. As a result, NPDES permitted facilities in Washington are required to ensure that effluent discharge does not raise the temperature in receiving waters above site-specific minimum temperature standards. Facilities employ a range of temperature control strategies to meet these standards.

To comply with the salmonid temperature criteria, NPDES-permitted facilities identify and employ a host of temperature control procedures through Temperature Management Plans (TMPs). Controls include process optimization, pollution prevention, land application, and cooling towers.

Potential economic impacts include the costs of complying with TMPs, including the necessary operations and maintenance (O&M) costs and capital expenditures. A range of possible compliance costs is available based on EPA's Economic Analysis of the Proposed Water Quality Standards Rule for the State of Oregon.[305]

Economic impacts vary depending on a facility's location within salmonid spawning, rearing, or migrating areas, existing compliance with temperature standards, specific processes and generated effluent, and whether a facility is subject to temperature requirements. NPDES-permitted facilities have always been required to adhere to certain temperature criteria associated with effluent discharge. However, the 2003 guidance has led to stricter standards where salmonids are known to spawn or rear. This analysis relies on GIS data[306] identifying cold, high elevation stream reaches where bull trout are known to spawn and rear and GIS data identifying the location of major and minor NPDES-permitted facilities.[307] GIS analysis indicates that the majority of NPDES-permitted facilities are found in more populous and low elevation areas. The only NPDES facilities found in the higher elevation were sand and gravel and other mining operations. While mining and gravel pit operations could have an impact on stream temperature, this analysis assumes that relatively low discharge flows from lagoon type systems are unlikely to incur costs associated with temperature management plans as found at low elevation

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305 Science Applications International Corporation, September 2003, "Economic Analysis of the Proposed Water Quality Standards Rule for the State of Oregon," prepared for U.S. Environmental Protection Agency, Office of Water.

306 Washington Department of Ecology, GIS data for surface water quality standards, 2003 Use Classification Standards. Personal communication with Andrew Kolosseus, Washington Department of Ecology, May 17, 2004.

307 Washington Department of Ecology, Water Quality Permit Life Cycle System (WPLCS). Identifies location of NPDES-permitted facilities as of 2004. http://www.ecy.wa.gov/programs/wq/permits/wplcs/index.html

facilities. Therefore, the analysis does not estimate economic impacts attributable to temperature control from these facilities.

3.15 Effects from Habitat Conservation Plans Under Development

In addition to the HCP agreements with existing "incidental take" coverage for bull trout (Section 3.2.2.2), this analysis considers, where feasible, the implementation costs associated with HCP plans currently under development. Specifically, this analysis focuses on five HCP agreements currently under development for the Coastal-Puget Sound population of bull trout. These HCP agreements have not been signed and are not official, but the Service considers their completion reasonably likely.[308]

Other non-Federal entities are likely considering, and perhaps negotiating, HCP agreements to cover various listed species including bull trout. It is also likely that new HCPs will be conceived and implemented at some point over the next 20 years. However, this analysis does not consider these "yet to be developed" HCPs given the uncertainty associated with the future intention of these entities.

The economic effects associated with future implementation of the five HCPs under development are apportioned as prospective costs on lands proposed for critical habitat and extend until 2024, the time frame used in this analysis.

The major activities covered by the five HCPs currently under development are highlighted below, including specific conservation measures and, where possible, economic effects associated with *implementation* of associated conservation measures.[309]

3.15.1 City of Kent

The City of Kent is between the cities of Seattle and Tacoma, on the southeast side of Puget Sound, along the Green River (Map 12). The City withdraws municipal drinking water supplies from Rock Creek, a tributary to the lower Cedar River. In 2003, the City initiated HCP negotiations primarily due to the listing of the Chinook salmon present in the lower Cedar River. The City is seeking "incidental take" coverage through the HCP process primarily to prevent impacts to listed salmon, though bull trout and eight other unlisted species are also included. Due to the relative size of the HCP planning area and the small number of activities impacted, the HCP is expected to be complete by 2007.[310]

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308 Personal communication with Service HCP Manager, Lacey, Washington, January 31, 2005.

309 As noted previously, *development costs* associated with HCP agreements are shown for illustrative purposes only; these figures are not included in the economic effects associated with HCPs estimated in this analysis (i.e., *implementation costs*).

310 Personal Communication with Service Biologist, Olympia, Washington, February 1, 2005.

The HCP would cover approximately 300 acres of city-owned land in the area of the withdrawal, in the lower Cedar River Watershed. Specific conservation measures are still being negotiated, but may include the curtailment of water withdrawal during salmon migration periods to augment seasonal flow.[311] This analysis does not estimate the economic effects of this HCP because (1) the conservation activities, including curtailed water withdrawals and other mitigation activities are uncertain and cost estimates are not feasible and (2) the tributary that supports the City's water withdrawals does not support proposed bull trout critical habitat.[312]

3.15.2 DUNGENESS CONSERVATION AND IRRIGATION DISTRICT MANAGEMENT PLAN

The Dungeness Conservation and Irrigation District's (DCID) service area lies in the upper Olympic Penninsula along the lower Dungeness River in Clallam County.[313] The district supplies water to agricultural land as well as to domestic lawns and gardens. The agriculture served in the district is highly varied and ranges from small five-acre farms to large dairies.[314]

The DCID started HCP negotiations in October of 2002 to cover water withdrawals, operating and maintaining diversion facilities, maintaining canals, discharging tailwater, releasing stormwater, and other construction activities. The HCP development process is expected to last up to five years and should be complete by 2007. The irrigated service area covered by the HCP covers approximately 28,340 acres of private agricultural land (Map 12). Species covered by the HCP include bull trout, Chinook and chum salmon, and five unlisted species.[315]

Specific conservation activities are still being negotiated but are likely to include periodic curtailment of water withdrawals, and infrastructure upgrades. Table 79 summarizes the estimated costs of implementing the expected HCP conservation measures, based on discussion with the Irrigation District. These costs are expected to be approximately $16.1 million ($2004). It is assumed that all of these costs are spread evenly during the timeframe of this analysis (2007-2024). Therefore, average annual costs are estimated by dividing by 18 years. For the purpose of estimating relative economic impacts per watershed, the total cost will be distributed proportionally by acres across three fifth-field HUC watersheds containing Dungeness Irrigation District Lands.

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[311] It is also possible that lands within the Rock Creek and Cedar River watersheds will be acquired, but there are no definitive plans at this time.

[312] The lower portion of the Cedar River Watershed does not contain designated stream reaches for bull trout.

[313] Personal communication with Andrew Graham, HDR/EES, Olympia, Washington, February 1, February 4, and February 8, 2005; and Sequim-Dungeness Valley Agricultural Water Users Association, February 25, 2004, Comprehensive Irrigation District Management Plan, p. ES-7.

[314] Personal communication with Mike Jeldness, Coordinator, Sequim-Dungeness Agricultural Water Users, February 10, 2005.

[315] Personal communication with Service Biologist, Olympia, Washington, February 1, 2005.

Table 79
Estimated Costs Associated with
Dungeness Conservation and Irrigation District Habitat Conservation Plan

HCP Conservation Activity	Estimated Total Cost[a/]	Average Annual Estimated Cost
Water conservation actions, (lining ditches with pipes and other infrastructure improvements to reduce water usage)	$9,178,000	$510,000
Reservoir Storage (Atterberry) to reduce irrigation diversions in August and September	$3,467,000	$193,000
Major construction projects to improve diversion outtakes for fish habitat enhancement	$3,059,000	$170,000
Small construction projects to improve diversion outtakes for fish habitat enhancement	$306,000,	$17,000
Training and equipment to improve operational practices related to channel maintenance to reduce potential habitat impacts	$102,000	$6,000
Total	**$16,112,000**	**$895,000**

a/ Costs inflated from 2003 to 2004 dollars using the U.S. Department of Commerce, Bureau of Economic Analysis, August 27, 2004, Gross Domestic Product: Implicit Price Deflator.

Source: Sequim-Dungeness Valley Agricultural Water Users Association, February 25, 2004, Comprehensive Irrigation District Management Plan, p. ES-7.

3.15.3 KING COUNTY WASTEWATER TREATMENT DIVISION HCP

King County's Wastewater Treatment Division (KCWTD) was started in 1958 as the Municipality of Metropolitan Seattle in 1958. The Division provides wastewater treatment to about 1.4 million people and 133 significant industrial users in 18 cities, 15 water and sewer districts, and for the Muckleshoot Indian Tribe. The Division treats about 180 to 200 million gallons of sewage per day and operates 335 miles of sewer lines. The Division currently operates three wastewater treatment plants, and is building a fourth in Snohomish County north of Woodinvale.[316]

In 2000, KCWTD initiated negotiations with the Service and NOAA Fisheries for an HCP to cover wastewater discharges, construction, and other activities. The lands covered by the HCP include the

[316] King County Wastewater Treatment Division, January 26, 2005, "Facts at a Glance," http://dnr.metrokc.gov/wtd/wtdfacts.htm, accessed February 10, 2005. King County Wastewater Treatment Division, February 8, 2005, "Brightwater Treatment Plant," http://dnr.metrokc.gov/wtd/brightwater/, accessed February 10, 2005.

entire County service area, (350,000 acres), including rights of way in Seattle and surrounding areas. Bull trout and Chinook salmon are included in the HCP, along with 26 other listed and unlisted species (Map 12).

The County currently plans to complete the HCP in two phases. Phase One will address secondary discharges, operations and maintenance, and construction. Phase Two is expected to address combined sewer overflows, water reclamation, conveyance system improvements, Vashon Island Treatment Plant facilities and operations, inflow and infiltration, and the Carnation Treatment Plant. The County anticipates that preparation of the Plan will be complete by early 2006.[317]

The HCP would cover KCWTD's activities for 40 years and is expected to cost a total of $13 million, elements of which are spread over different time periods (Table 80).[318] This study assumes all of these costs are incurred within the timeframe of this analysis (2006-2024). Therefore, average annual costs are estimated by dividing total costs by 19 years. Although an exact breakout of expenses is not available, activities and costs in the Plan include efforts to reduce the total wastewater stream, $50,000 per year; fish habitat mitigation measures, $3 million in total; Best Management Practices (BMP) for construction, costs unknown but likely to be a percentage of the total construction costs; and a training course on BMPs and ESA requirements, which will likely require hiring a half-time trainer for at least ten years.[319]

Table 80
Estimated Costs Associated with
King County Wastewater Treatment Division HCP

HCP Conservation Activity	Expected Total Cost	Years Incurred
Reduce Wastewater Stream	$2,000,000	2006-2024
Fish Habitat Mitigation	$3,000,000	2006-2024
BMP/ESA Training Course	$300,000	2006-2021
Other activities	$7,700,000	2006-2024
Total Costs	**$13,000,000**	**2006-2024**

[317] Personal communication with Steve Gilbert, HCP Project Manager, King County Wastewater Treatment Division, February 1, 3, and 7, 2005. King County Wastewater Treatment Division, August 11, 2004, "Habitat Conservation Plan," http://dnr.metrokc.gov/wtd/hcp/, accessed February 10, 2005. King County Wastewater Treatment Division, May 30, 2003, "Frequently Asked Questions about the HCP," http://dnr.metrokc.gov/wtd/hcp/faq.htm, accessed February 10, 2005.

[318] Personal communication with Steve Gilbert, HCP Project Manager, King County Wastewater Treatment Division, February 1, 3, and 7, 2005.

[319] Personal communication with Steve Gilbert, HCP Project Manager, King County Wastewater Treatment Division, February 1, 3, and 7, 2005.

Average Annual Costs	**$684,000**	

Implementation costs associated with the KCWTD HCP appear low relative to the costs of the Dungeness Irrigation District HCP, which covers a smaller area. However, the Dungeness Irrigation District HCP includes a large number of construction projects and other infrastructure improvements, whereas the KCWTD HCP provides "incidental take" coverage for conservation measures and infrastructure improvements that have been ongoing.[320]

3.15.4 WASHINGTON DEPARTMENT OF NATURAL RESOURCES AQUATIC LANDS

In 2003, the Washington DNR initiated negotiations for a comprehensive multi-species HCP addressing all state-owned aquatic lands and associated activities managed by the state agency. The HCP covers approximately 2.4 million acres, including tidelands, shorelands, and submerged bedlands (Map 12). The Plan will cover at least 86 listed and unlisted species. The agency expects to complete the plan by 2008.[321]

Washington DNR manages lands and sediments underlying Washington State waters, as well as benthic organisms and minerals. The WDNR authorizes the use of submerged lands for various activities, including water-dependent and non-water-dependent activities. Water dependent activities include aquaculture, water-borne transportation of people and goods including the Washington State Ferry system, marinas and other public access to water, and dredging for navigation. Non-water dependent activities include freshwater and marine construction, outfalls, and sand and gravel operations.[322]

No conservation activities have been proposed for the HCP and therefore costs estimates are not feasible. Estimating the type, number, and extent of DNR-authorized activities on aquatic lands – and subsequent conservation activities -- is beyond the scope of this analysis. Given the uncertainty associated with these future activities and the ongoing nature of the HCP negotiation, this analysis does not estimate implementation costs associated with this HCP.[323]

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[320] Personal communication with Steve Gilbert, HCP Project Manager, King County Wastewater Treatment Division, February 7, 2005.

[321] Personal communication with Service Section 6 Grants Program Personnel, Olympia, Washington, February 3, 2005; personal communication with Service Biologist, Olympia, Washington, February 1, 2005.

[322] Personal communication with Carol Piening, ESA Compliance Team, Washington State Aquatic Resource Program, Olympia, Washington, February 1, February 3, February 8, and February 10, 2005.

[323] However, implementation costs are expected to be significant, given the extent of lands and activities covered by the agreement. For example, the total development costs associated with the HCP are projected to be $5 million (inclusive of some initial implementation costs).

3.15.5 WASHINGTON STATE FOREST PRACTICE RULES HCP

The Washington Forest Practice Rules were passed by the Washington legislature to address environmental concerns related to the Federal listing of various fish species and the subsequent publication of the Forest and Fish Report (1999). The Rules include fish-related conservation measures, such as riparian area buffers, road maintenance and abandonment plans, and unstable slope protections. The rules apply specifically to privately owned timberlands. State owned DNR timber lands follow similar fish conservation measures administered through the DNR HCP.

The Washington State Forest Practice Rules HCP was initiated in 2000 and, once complete, will provide "incidental take" coverage to both private and state owned timber lands (e.g., DNR timber lands) for timber harvest related activities (e.g., timber harvest, road construction, culverts, etc.). Because similar fish-related conservation measures are currently being implemented on both private and state timber lands and because the impacts associated with these activities are quantified elsewhere in this report (see Section 3.5) this analysis does not estimate any additional costs associated with the Washington Forest Practice Rules HCP.

3.15.6 SUMMARY OF HCPS UNDER DEVELOPMENT

The potential economic impacts associated with HCPs currently under development are presented in Table 81. This includes an estimated $1.6 million, attributed as prospective annualized costs to proposed critical habitat.

Table 81
Potential Economic Impacts to HCPs Under Development

Coastal-Puget Sound	Retrospective (Total)	Prospective (Total)		Prospective (Annualized)
		3%	7%	
Proposed Critical Habitat				
City of Kent	-[a/]	$0	$0	$0
Dungeness	$0	$13,318,0000	$9,483,0000	$895,0000
King County	$0	$10,179,000	$7,249,0000	$684,0000
WA DNR Aquatic	-[a/]	$0	$0	$0
WA Forest Practice Rules	$0[b/]	$0	$0	$0
Total Proposed Critical Habitat	**$0**	**$23,497,000**	**$16,732,000**	**$1,579,000**
Proposed for Exclusion	**$0**	**$0**	**$0**	**$0**
Excluded	**$0**	**$0**	**$0**	**$0**

[a/] Information on HCP implementation costs is not available.

[b] This analysis assumes costs associated with the Washington Forest Practice Rules are not significant due to the fact that most landowners are already abiding by these existing conditions. These effects are estimated in the section related to private non HCP timber lands (see Section 3.5).

3.16 Administrative Costs of Consultation

3.16.1 Section 7 Consultations

Federal agencies are required to consult with the Service on activities that they authorize, fund, or carry out to ensure that the activities do not jeopardize a listed species or adversely modify or destroy designated critical habitat. In some cases, third parties such as local government or private entities participate in the consultation process along with the Federal action agency when the proposed project has a Federal nexus.

Section 7 consultations can take a variety of forms. The majority of consultations are "informal." Informal consultations occur when the Service, Action agency, and the applicant are able to identify and resolve potential concerns to the listed species at an early stage in the planning process. In some cases, it is determined that the proposed action may adversely affect the listed species or designated critical habitat. These instances can require "formal" consultation whereby the Service issues a Biological Opinion stating if the proposed action is likely to jeopardize a species or adversely modify critical habitat and provides recommendations on appropriate conservation activities to avoid the impacts.[324]

Table 82 provides a summary of the bull trout consultation record for the Coastal-Puget Sound region through early 2004. As shown, the majority of the consultations have been informal since bull trout were listed. Less than ten percent of the consultations have been formal.

Table 82
Service Bull Trout Consultations by Year and Type[a]

Year	Total	Formal	Informal	Conference
1998	16	2	13	1
1999	155	14	79	62
2000	317	35	274	8
2001	493	37	456	0
2002	399	29	368	2

[324] U.S. Fish and Wildlife Service and National Marine Fisheries Service, March 1998, "Consultation Handbook, Procedures for Conducting Consultation and Conference Activities Under Section 7 of the Endangered Species Act," pp. xi-xii.

2003	504	24	480	0
2004	347	31	316	0
Total	**2,231**	**172**	**1,986**	**73**

[a/] Does not include emergency or technical assistance consultations.

As shown by Figure 2, 77 percent of the past consultations have involved the U.S. Army Corps of Engineers (USACE) and the Federal Highway Administration (FHWA). USACE regulates flood control and damage reduction efforts. In addition, USACE permits dredging and construction activities affecting waterways under authority provided by the CWA. FHWA provides funding to many of the road and bridge projects administered by the Washington Department of Transportation (WDOT). Projects that may impact streams with listed bull trout can result in a section 7 consultation with FHWA as the Action agency. Consultations can involve road projects that are distant from streams due to concern over impervious surfaces and sedimentation. Other Action agencies that commonly consult on bull trout include the Housing and Urban Development Department (HUD), Bureau of Indian Affairs (BIA), U.S. Forest Service (USFS), and internal Service (FWS) consultations. Other Action agencies with more than ten consultations in the record include the U.S. Navy, EPA, FERC, USDA, and FEMA.

Section 7 consultations require a considerable amount of time and effort for the Service, Action agencies, and third parties and can result in substantial administrative costs. Table 83 presents cost estimates for the categories of consultations presented above. The costs are associated with meetings, preparation, and documentation during the consultation. In addition, average costs required to develop Biological Assessments (BAs) are included.[325]

325 It is assumed that the hours required to develop the BA by the Action agency and third party are equal but that per hour costs are higher for third parties.

Figure 2
Consultations by Action Agency, 1998 to Present

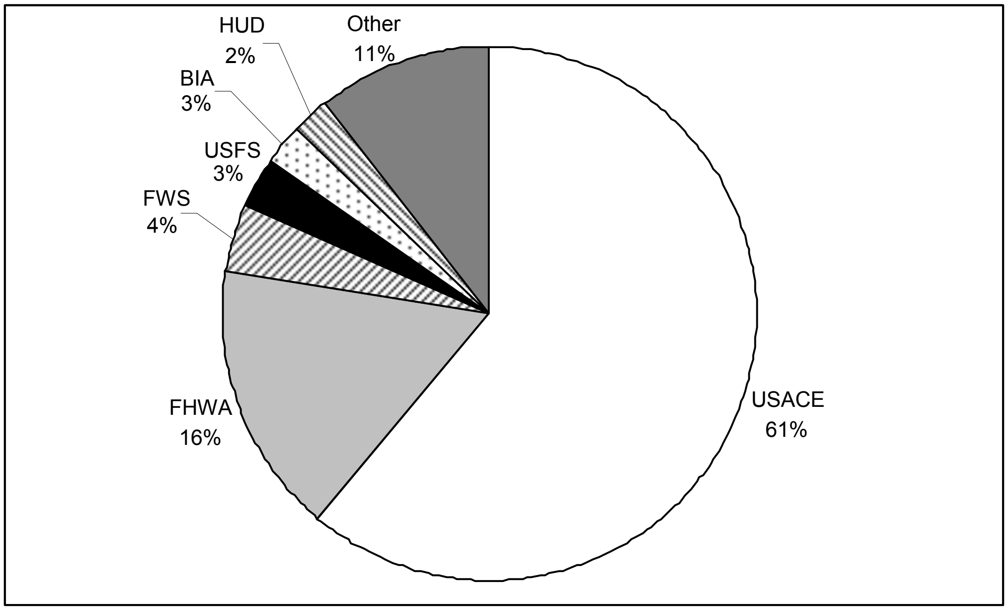

Table 83
Estimated Administrative Costs of Section 7 Consultations

	Formal	Informal	Conference[a/]
Service			
Consultation Cost	$25,900	$1,100	$1,100
Action Agency			
Consultation Cost	$20,200	$3,900	$3,900
BA Cost	$34,200	$3,200	$3,200
Third Party Costs			
Consultation Cost	$3,600	$1,200	$0
BA Cost	$40,600	$3,800	$0

[a/] Conferences are assumed to involve the Service and Action Agency only and are assigned the same costs as informal consultations.

Source: Industrial Economics, Inc., analysis based on data from the Federal Government General Schedule Rates, 2002, Office of Personnel Management, and level of effort information from U.S. Fish and Wildlife Service, USACE, USFS, USBR, and DOT.

Total administrative costs are presented in Table 84. Prospective annualized costs were calculated by multiplying the average costs per type of consultation by the number of consultations projected to occur each year.[326] Total prospective costs are estimated from annual costs by applying a three and seven percent discount rate over a 20-year period.

Table 84
Estimated Section 7 Administrative Costs

Category	Retrospective (Total)	Prospective (Total)		Prospective (Annualized)
		3%	7%	
Section 7 Administrative Costs	$40,508,000	$109,573,000	$78,025,000	$7,365,000

3.17 Potential Effects on Tribal Entities

As discussed in Section 3.1.4, there are 14 Indian reservations and associated tribal land in the Coastal-Puget Sound region that include or are adjacent to proposed critical habitat. Secretarial Order 3206 articulates that tribal governments have the authority to protect and manage their resources in a manner that is most beneficial to their tribe. As trustee for land held in trust by the United States on behalf of tribes, the BIA provides technical assistance and planning, and oversees a variety of programs on tribal lands. This section provides a discussion of the potential effects on tribal activities on their reservations. The administrative costs associated with section 7 consultation for activities occurring on tribal lands are included above in Section 3.15.

The tribes, relevant proposed CHD affecting their reservation, and the unit and CHSU in which they are located are presented in Table 85. In each case, one or more inland stream or rivers passing through or adjacent to tribal land is proposed for critical habitat. However, eight of the 14 reservations also contain nearshore marine habitat as proposed CHD. In addition, two reservations (Quinault and Hoh) contain areas that are proposed for exclusion from critical habitat.

The tribes of western Washington have considerable cultural affinity to the harvesting of fish and wildlife in the region, and for most, if not all, commercial fishing is an important foundation for their tribal economy. In the 1850s, at the time when Washington was made a state, a series of treaties were negotiated with the tribes of the region.[327] These treaties reserved the rights of the tribes to, among other things, harvest fish in common with other citizens of the United States. A court decision in 1974 known as the Boldt decision (*U.S. v. Washington*), and subsequent interpretation, the tribes' status reinforced their role as co-managers of harvestable fishery resources in Washington waters.

[326] It is assumed that future consultations will occur at the same average annual rate indicated by the consultation record.

[327] The treaties include the Treaty of Olympia (1855), Treaty of Medicine Creek (1854), Treaty of Point Elliot (1855), and Treaty of Point No Point (1855).

Following the Boldt decision, western Washington tribes formed the Northwest Indian Fisheries Commission (NWIFC) to "assist … in conducting orderly and biologically sound fisheries." Thirteen of the fourteen tribes (excluding the Chehalis) identified in Table 85 are members of the NWIFC.[328]

The NWIFC provided comments to the Service on behalf of its members on the proposed CHD. In their letter, the NWIFC asserts that designation of Indian lands would impose "special" costs on individual Indian or tribal beneficiaries. It is asserted that the costs include those associated with NEPA, section 7 consultation costs, and tribal planning. In particular, costs for the Harvest and Hatchery Resource Management Plans (RMPs) were cited as examples of relevant costs.[329] In this economic analysis, no additional costs associated with NEPA compliance or RMPs were included as attributable to bull trout, since these were promulgated by the listed salmon and steelhead proposed 4(d) rule. Section 7 third-party consultation costs were estimated and included above in Section 3.15 [link]. It is acknowledged that an undetermined level of effort was provided by tribal staff in developing data for the recovery plan on the Hoh, Nooksack, Skagit, and Skokomish rivers.

Table 85
Unit and CHSUs with Tribal Land Potentially Affected by the Proposed Bull Trout CHD

Tribe	Relevant Proposed CHD (portions or all of listed stream or nearshore area)	CHSU
Unit 27 – Olympic Peninsula River Basins		
Chehalis Confederated Tribes	Chehalis River	Chehalis River/Grays Harbor
Hoh Tribe	Hoh River Pacific Coast Nearshore	Hoh Pacific Coast
Jamestown S'Klallam Tribe	Dungeness River	Dungeness
Lower Elwha S'Klallam Tribe	Elwha River Strait of Juan de Fuca Nearshore	Elwha Strait of Juan de Fuca
Quinault Nation	Quinault River Lake Quinault Raft River Queets River Salmon River Moclips River Cook Creek Elk Creek Pacific Coast Nearshore	Queets Quinault Pacific Coast

328 Northwest Indian Fisheries Commission, http://www.nwifc.wa.gov/aboutus/overview.asp.

329 Andersen, James R., Northwest Indian Fish Commission, Executive Director, August 24, 2004, Letter to Bull Trout Coordinator, U.S. Fish and Wildlife Service, pp. 4-5.

Tribe	Relevant Proposed CHD (portions or all of listed stream or nearshore area)	CHSU
Skokomish Tribe	Skokomish River Nalley Slough Skobob Creek Hood Canal Nearshore	Skokomish Hood Canal
Unit 28 – Puget Sound River Basins		
Lummi Nation	Nooksack River Puget Sound Nearshore	Nooksack Puget Sound Marine
Muckleshoot Tribe	White River	Puyallup
Nisqually Tribe	Nisqually River	Lower Nisqually
Nooksack Tribe	Nooksack River	Nooksack
Puyallup Tribe	Puyallup River Puget Sound Nearshore	Puyallup Puget Sound Marine
Sauk-Suiattle Tribe	Sauk River	Lower Skagit
Swinomish Tribe	Swinomish Channel Puget Sound Nearshore	Puget Sound Marine
The Tulalip Tribes	Snohomish River Puget Sound Nearshore	Snohomish-Skykomish Puget Sound Marine

Tribal staff from individual tribes have engaged in recovery and restoration efforts in the course conducting natural resource management activities have contributed to conservation efforts for bull trout. For example, the Swinomish Tribal Community has instituted a number of restoration projects, developed stormwater management rules, implemented water quality monitoring, and developed a method for assessing the quantity and quality of nearshore habitat.[330] The Skokomish Tribe cites its land use codes, water quality standards, and update of its forest management plan as related actions.[331] The Muckleshoot Indian Tribe has designated all areas of the White River within the reservation boundaries as a "conservation zone."[332]

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330 Foster, Alix, Swinomish Tribal Community, Director, Office of Tribal Attorney, May 18, 2004, Letter to Chief, Listing and Candidate Conservation, U.S. Fish and Wildlife Service, p. 7.

331 Ereth, Marty, Skokomish Natural Resources, Habitat Biologist, August 24, 2004, "Comments Supporting an Exclusion of Skokomish Tribal Lands from a Critical Habitat Designation," p. 6.

332 Stay, Alan C., Muckleshoot Indian Tribe, Attorney, August 23, 2004, Letter to Bull Trout Coordinator, U.S. Fish and Wildlife Service, p. 2.

Several tribes have also expressed concern about the effects of critical habitat on developments proposed by tribal governments.[333] These specific costs, when warranted, are addressed and included elsewhere in this analysis, as administrative costs or those associated with project modification.

3.18 Potential Effects on Small Entities

Under the RFA (as amended by the SBREFA), whenever a Federal agency is required to publish a notice of rulemaking for any proposed or final rule, it must prepare and make available for public comment a regulatory flexibility analysis that describes the effect of the rule on small entities. However, no regulatory flexibility analysis is required if the head of an agency certifies that the rule will not have a significant economic impact on a substantial number of small entities.[334] SBREFA amended the RFA to require Federal agencies to provide a statement of the factual basis for certifying that a rule will not have a significant economic impact on a substantial number of small entities. Accordingly, a screening level analysis of the potential effects of the CHD rulemaking on small entities is included in Appendix A.

3.19 Potential Effects on Energy Supply

Executive Order No. 13211, "Actions Concerning Regulations that Significantly Affect Energy Supply, Distribution, or Use," issued May 18, 2001 requires Federal agencies to submit a "Statement of Energy Effects" for all "significant energy actions" in order to present consideration of the impacts of a regulation on the supply, distribution, and use of energy.[335] Potential effects on the energy supply are addressed in Appendix A.

3.20 Summary and Analysis of Effects in the Coastal-Puget Sound Region

3.20.1 Summary of Findings

This section provides a summary of the economic effects associated with co-extensive salmon and bull trout conservation activities in the Coastal-Puget Sound region for each of the activities considered in this analysis. Table 86 reflects the activities and the cost estimates reflect the fully co-extensive fish conservation costs such that, in HUCs where bull trout proposed critical habitat is designated overlaps with ESUs of listed salmon species, all of the costs associated with fish-related conservation measures are

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333 For example, the Swinomish Tribe has expressed concerns about section 7 consultation costs and permitting associated with a proposed marina development. (Foster, Alix, Swinomish Tribal Community, Director, Office of Tribal Attorney, May 18, 2004, Letter to Chief, Listing and Candidate Conservation, U.S. Fish and Wildlife Service, p. 13.)

334 Thus, for a regulatory flexibility analysis to be required, impacts must exceed a threshold for "significant impact" and a threshold for a "substantial number of small entities." See 5 U.S.C. § 605(b).

335 Daniels, Mitchel E., July 13, 2001, "Memorandum for Heads of Executive Departments and Agencies, and Independent Regulatory Agencies," M-01-27, http://www.whitehouse.gov/omb/memoranda/m01-27.html.

included. Results are presented for the three categories of analysis: proposed critical habitat, proposed for exclusion, and excluded.

When considering salmon and bull trout co-extensive retrospective costs in proposed critical habitat total $241.5 million with non-hydroelectric projects and Federal land management bearing $87.4 and $50.4 million of the costs, respectively. Retrospective costs in areas proposed for exclusion are $236.8 million, and those for excluded areas are $68.9 million. The costs in these latter two categories are primarily associated with the effects of implementing the Forest and Fish Report on private forestlands, and conservation measures on HCP lands.

Total prospective costs on proposed critical habitat are $679.3 million assuming a seven percent discount rate. Annualized prospective costs are estimated to be $60.8 million. Costs associated with development contribute more than 49 percent of the overall prospective costs.[336] Other cost leading activities include Federal land management (13 percent), non-hydroelectric projects (11 percent), and hydroelectric projects (10 percent). For areas proposed for exclusion, the total prospective costs are $213.4 million, with annualized prospective costs estimated to be $20.1 million. These apply entirely to the private forestlands not covered by an HCP.

Table 86
Summary of Economic Effects Associated with Co-Extensive Salmon and Bull Trout Conservation Activities in the Coastal-Puget Sound Region: Proposed Critical Habitat, Proposed for Exclusion, and Excluded Areas

Category of Effect	Retrospective (Total)	Prospective (Total)		Prospective (Annualized)
		3%	7%	
Residential/Commercial Development	$0	$389,242,000	$277,173,000	$26,163,000
Hydroelectric Projects	$7,173,000	$101,938,000	$70,720,000	$5,124,000
Non-Hydroelectric Projects	$87,401,000	$154,244,000	$82,732,000	$5,995,000
Federal Land Management (USFS)	$50,448,000	$103,448,000	$73,664,000	$6,953,000
Private Non-HCP Forestry	$0	$0	$0	$0
HCP Lands	$411,000	$34,908,000	$24,857,000	$2,346,000
Road Maintenance and Transportation	$17,472,000	$26,409,000	$18,806,000	$1,775,000

[336] Percentages are calculated on total costs, net of administrative consultation costs.

Commercial and Recreational Mining	$0	$5,309,000	$3,780,000	$357,000
Utilities	$1,025,000	$1,863,000	$1,327,000	$125,000
Dredging Activities	$6,824,000	$14,007,000	$9,974,000	$941,000
Instream Activities	$27,753,000	$49,832,000	$35,484,000	$3,349,000
Culverts	$2,483,000	$3,920,000	$2,791,000	$263,000
NPDES-Permitted Facilities	$0	$0	$0	$0
Administrative Consultation Costs[a/]	$40,508,000	$109,573,000	$78,025,000	$7,365,000
Total Proposed Critical Habitat	**$241,498,000**	**$994,693,000**	**$679,333,000**	**$60,756,000**
Proposed for Exclusion	**$236,775,000**	**$299,710,000**	**$213,419,000**	**$20,145,000**
Excluded	**$68,933,000**	**$221,094,000**	**$157,438,000**	**$14,861,000**

Totals may not sum due to rounding.

[a/] Administrative consultation costs are based on the historic consultation record and are not apportioned to specific HUC watersheds.

3.20.2 Discussion of Results by CHSU

As noted earlier, the Service proposed critical habitat in the form of specific stream reaches, and in accompanying geographic areas. These critical habitat subunits generally follow watershed boundaries and encompass these stream reaches. The two units (Olympic and Puget Sound) contain ten and 13 CHSUs, respectively. Table 87 provides a summary of economic effects associated with co-extensive salmon and bull trout conservation activities by CHSU for the two units. The results in this table correspond to the results presented in Table 86 for the proposed critical habitat.

Table 87
Summary of Economic Impacts Associated with Co-Extensive Salmon and Bull Trout Conservation Activities by CHSU: Proposed Critical Habitat

Unit	CHSU	Retrospective (Total)	Prospective (Total)		Prospective (Annualized)
			3%	7%	
Olympic	Skokomish	$2,515,000	$38,681,000	$27,544,000	$2,600,000
Olympic	Dungeness	$996,000	$11,262,000	$8,020,000	$757,000
Olympic	Elwha	$281,000	$669,000	$477,000	$45,000
Olympic	Hoh	$292,000	$922,000	$657,000	$62,000
Olympic	Queets	$1,703,000	$3,749,000	$2,670,000	$252,000
Olympic	Quinault	$1,780,000	$2,767,000	$1,970,000	$186,000
Olympic	Hood Canal	$210,000	$833,000	$593,000	$56,000
Olympic	Strait of Juan de Fuca	$798,000	$6,739,000	$4,799,000	$453,000
Olympic	Pacific Coast	$53,000	$208,000	$148,000	$14,000

Olympic	Chehalis River/ Grays Harbor	$6,000,000	$24,578,000	$17,501,000	$1,652,000
Puget Sound	Chilliwack	$372,000	$848,000	$604,000	$57,000
Puget Sound	Nooksack	$4,573,000	$17,094,000	$12,173,000	$1,149,000
Puget Sound	Lower Skagit	$14,055,000	$79,520,000	$56,625,000	$5,345,000
Puget Sound	Upper Skagit	$10,044,000	$10,013,000	$7,130,000	$673,000
Puget Sound	Stillaguamish	$5,520,000	$15,755,000	$11,219,000	$1,059,000
Puget Sound	Snohomish/Skykomish	$11,779,000	$67,321,000	$47,938,000	$4,525,000
Puget Sound	Chester Lake	$453,000	$10,459,000	$7,448,000	$703,000
Puget Sound	Puyallup	$8,560,000	$106,285,000	$75,684,000	$7,144,000
Puget Sound	Samish	$1,509,000	$7,573,000	$5,392,000	$509,000
Puget Sound	Lake Washington	$28,475,000	$108,933,000	$77,569,000	$7,322,000
Puget Sound	Lower Green	$72,849,000	$185,269,000	$131,927,000	$12,453,000
Puget Sound	Lower Nisqually	$417,000	$4,716,000	$3,358,000	$317,000
Puget Sound	Puget Sound Marine	$2,325,000	$56,951,000	$40,554,000	$3,828,000
Outside of Proposed CHSUs		**$26,383,000**	**$33,236,000**	**$23,667,000**	**$2,234,000**
Administrative Consultation Costs[a/]		**$40,508,000**	**$109,573,000**	**$78,025,000**	**$7,365,000**
Total – Proposed Critical Habitat		**$241,498,000**	**$994,693,000**	**$679,334,000**	**$60,756,000**

a/ Administrative consultation costs were not apportioned by CHSU.

For the total retrospective costs of $241.5 million, the CHSU with the highest costs is Lower Green at $72.8 million, followed by Lake Washington ($28.5 million), the Lower Skagit ($14.1 million), and Snohomish/Skykomish ($11.8 million). Lower Green and Lake Washington include relatively high costs from non-hydroelectric facilities (Hansen Dam and Chittenden Locks) and the King County HCP.

For total prospective costs of $679.3 million, the CHSU with the highest costs is the Lower Green, at $131.9 million, followed by Lake Washington at $77.6 million, Puyallup ($75.7 million), Lower Skagit ($56.6 million), Snohomish/Skykomish ($47.9 million), and Puget Sound Marine ($40.6 million). All six areas are highly urbanized and subject to high development costs. Puget Sound Marine encompasses a relatively long coastal marine area along the entire east shore of the Puget Sound. It is also urbanized and has high costs associated with development.

Table 88 presents areas proposed for exclusion by CHSU. The category of retrospective costs, "Outside of Proposed CHSUs," includes lands identified through spatial analysis to be within a WRIA watershed (see Section 2.2), but not in a CHSU. They include those private forest lands proposed for exclusion under the Forests and Fish Report. Among the prospective costs, the CHSU with the highest costs are Snohomish/Skykomish at $37.3 million. This is followed by Chehalis River/Grays Harbor ($37.2 million), Puyallup ($30.4 million), and Lower Skagit ($24.4 million). These CHSUs contain large areas on private forest lands that are proposed for exclusion.

Table 89 contains the results for excluded areas by CHSU. The Chehalis River/Grays Harbor CHSU contains the highest prospective costs, at $29.1 million. This is followed by Chester Lake, at $20.6 million, and three CHSUs (Strait of Juan de Fuca, Queets, and Hood Canal) in the Olympic Unit at $9.0 to 14.1 million each. The excluded lands are all associated with completed HCPs.

Table 88
Summary of Economic Effects Associated with Co-Extensive Salmon and Bull Trout Conservation Activities by CHSU: Proposed for Exclusion

Unit	CHSU	Retrospective (Total)	Prospective (Total)		Prospective (Annualized)
			3%	7%	
Olympic	Skokomish	$977,000	$2,232,000	$1,589,000	$150,000
Olympic	Dungeness	$624,000	$1,428,000	$1,017,000	$96,000
Olympic	Elwha	$372,000	$848,000	$604,000	$57,000
Olympic	Hoh	$2,174,000	$4,984,000	$3,549,000	$335,000
Olympic	Queets	$1,398,000	$3,199,000	$2,278,000	$215,000
Olympic	Quinault	$834,000	$1,904,000	$1,356,000	$128,000
Olympic	Hood Canal	$0	$0	$0	$0
Olympic	Strait of Juan de Fuca	$2,967,000	$6,784,000	$4,831,000	$456,000
Olympic	Pacific Coast	$4,307,000	$9,864,000	$7,024,000	$663,000

Olympic	Chehalis River/ Grays Harbor	$22,837,000	$52,265,000	$37,217,000	$3,513,000
Puget Sound	Chilliwack	$12,000	$30,000	$21,000	$2,000
Puget Sound	Nooksack	$8,140,000	$18,627,000	$13,264,000	$1,252,000
Puget Sound	Lower Skagit	$14,950,000	$34,278,000	$24,409,000	$2,304,043
Puget Sound	Upper Skagit	$140,000	$267,000	$190,000	$17,957
Puget Sound	Stillaguamish	$9,791,000	$22,405,000	$15,955,000	$1,506,000
Puget Sound	Snohomish/Skykomish	$22,859,000	$52,324,000	$37,259,000	$3,517,000
Puget Sound	Chester Lake	$526,000	$1,205,000	$858,000	$81,000
Puget Sound	Puyallup	$18,674,000	$42,743,000	$30,437,000	$2,873,000
Puget Sound	Samish	$4,235,000	$9,700,000	$6,907,000	$652,000
Puget Sound	Lake Washington	$236,000	$536,000	$381,000	$36,000
Puget Sound	Lower Green	$4,343,000	$9,938,000	$7,077,000	$668,000
Puget Sound	Lower Nisqually	$10,546,000	$24,131,000	$17,183,000	1,622,000
Puget Sound	Puget Sound Marine	$0	$0	$0	$0
Outside of Proposed CHSUs[a/]		**$105,831,000**	**$0**	**$0**	**$0**
Total		**$236,775,000**	**$299,710,000**	**$213,419,000**	**$20,145,000**

Totals may not sum due to rounding.

[a/] Retrospective costs associated with "Outside of Proposed CHSUs" include lands identified through spatial analysis to be within a WRIA watersheds (see Section 2.2).

Table 89
Summary of Economic Effects Associated with Co-Extensive Salmon and Bull Trout Conservation Activities by CHSU: Excluded Lands

Unit	CHSU	Retrospective (Total)	Prospective (Total)		Prospective (Annualized)
			3%	7%	
Olympic	Skokomish	$1,164,000	$4,243,000	$3,022,000	$285,000
Olympic	Dungeness	$220,000	$656,000	$467,000	$44,000
Olympic	Elwha	$235,000	$700,000	$498,000	$47,000
Olympic	Hoh	$2,044,000	$6,083,000	$4,331,000	$409,000
Olympic	Queets	$4,233,000	$12,594,000	$8,968,000	$847,000
Olympic	Quinault	$15,000	$45,000	$32,000	$3,000
Olympic	Hood Canal	$5,733,000	$19,748,000	$14,062,000	$1,327,000
Olympic	Strait of Juan de Fuca	$5,156,000	$15,343,000	$10,925,000	$1,031,000
Olympic	Pacific Coast	$749,000	$2,227,000	$1,586,000	$150,000

Olympic	Chehalis River/ Grays Harbor	$11,883,000	$40,816,000	$29,065,000	$2,744,000
Puget Sound	Chilliwack	$0	$0	$0	$0
Puget Sound	Nooksack	$3,055,000	$9,091,000	$6,474,000	$611,000
Puget Sound	Lower Skagit	$3,211,000	$9,555,000	$6,804,000	$642,000
Puget Sound	Upper Skagit	$0	$0	$0	$0
Puget Sound	Stillaguamish	$2,931,000	$8,722,000	$6,210,000	$586,000
Puget Sound	Snohomish/Skykomish	$5,559,000	$16,572,000	$11,801,000	$1,114,000
Puget Sound	Chester Lake	$7,793,000	$28,969,000	$20,628,000	$1,947,000
Puget Sound	Puyallup	$69,000	$206,000	$146,000	$14,000
Puget Sound	Samish	$479,000	$1,424,000	$1,014,000	$96,000
Puget Sound	Lake Washington	$4,000	$10,000	$7,000	$1,000
Puget Sound	Lower Green	$1,736,000	$6,414,000	$4,567,000	$431,000
Puget Sound	Lower Nisqually	$669,000	$1,991,000	$1,418,000	$134,000
Puget Sound	Puget Sound Marine	$995,000	$2,959,000	$2,107,000	$199,000
Outside of Proposed CHSUs[a/]		**$10,998,000**	**$32,724,000**	**$23,303,000**	**$2,200,000**
Total		**$68,933,000**	**$221,094,000**	**$157,438,000**	**$14,861,000**

Totals may not add due to rounding
[a/] Retrospective costs associated with "Outside of Proposed CHSUs" include lands identified through spatial analysis to be within a WRIA watersheds (see Section 2.2).

3.20.3 Discussion of Results by Watershed

Table 90 shows the ten watersheds with the highest prospective annualized costs associated with co-extensive salmon and bull trout conservation activities. Nine of the ten are within the Puget Sound Unit, between the Skagit River in the north and the Puyallup River in the South, and seven of these contain significant development costs; not surprisingly, they encompass highly urbanized areas of Puget Sound. Together, these seven watersheds represent 48 percent of the total economic impact within proposed critical habitat.[337] Costs in the Middle Green River watershed are primarily attributable to conservation activities at the Howard Hansen Dam and the City of Tacoma's water diversion. High costs in the Baker River watershed are due primarily to the upper and lower Baker Dam, where significant capitals costs are expected associated with a fish passage project beginning in 2006. Together, these ten watersheds in

[337] Percentage calculated using total annual proposed critical habitat prospective costs, net of administrative consultation costs. Administrative costs were not apportioned to specific HUCs.

Coastal-Puget Sound represent 70 percent of the annualized economic impacts associated with the lands proposed for critical habitat.[338]

The watershed with the fifth highest prospective annualized cost is the Skokomish River, which flows southeast into the Hood Canal, in the Olympic Peninsula Unit. Capitals costs associated with the Cushman Hydroelectric Project fish passage improvement (anticipated to begin in 2006) are the most significant impacts in this watershed.

Additional detail on cost estimates for each watershed included in the analysis can be found in Appendix C. Map 13 demonstrates the relative economic impact per watershed (darker shading indicates higher costs).

Table 90
Highest Cost Watersheds in Coastal-Puget Sound Proposed Critical Habitat

Watershed Name (HUC Code)	CHSU	Annualized Prospective Costs	Highest Cost Category	Highest Cost Category (% Impact)
Lower Green River (1711001303)	Lower Green	$9,190,000	Development	93%
Lake Washington (1711001203)	Lake Washington	$7,322,000	Development & Non-Hydro	43% & 33%
Lower Puyallup River (1711001405)	Puyallup	$5,793,000	Development	93%
Middle Green River (1711001302)	Lower Green	$3,263,000	Non-Hydro	94%
Skokomish River (1711001701)	Skokomish	$2,600,000	Hydro	84%

338 Percentage calculated using total annual proposed critical habitat prospective costs, net of administrative consultation costs. Administrative costs were not apportioned to specific HUCs.

Snohomish River (1711001102)	Snohomish/ Skykomish	$2,517,000	Development	88%
Baker River (1710000508)	Lower Skagit	$2,264,000	Hydro	84%
Puget Sound/ East Passage[a/] (1711001904)	Puget Sound Marine	$1,634,000	Development	86%
Lower Skagit River/ Nookachamps Creek (1711000702)	Lower Skagit	$1,347,000	Development	89%
Chambers Creek[a/] (1711001906)	Puget Sound Marine	$1,232,000	Development	99%

[a/] Chambers Creek and Puget Sound/East Passage HUC watershed are both "nearshore marine habitat HUCs" and costs are adjusted to reflect this type of designation (see Section 2.2.1).

4.1 SOCIOECONOMIC PROFILE OF THE CRITICAL HABITAT AREA

This subsection presents key economic and demographic information, including population characteristics and general economic activity, for the counties containing proposed CHD for the Jarbidge River population of bull trout (Map 3).

4.1.1 LOCATION AND GEOGRAPHY OF THE JARBIDGE RIVER REGION

The Jarbidge River population encompasses the Jarbidge River watershed, which is located within Owyhee County in southwestern Idaho and Elko County in northeastern Nevada. The Jarbidge River population covers approximately 188,000 acres of land across six fifth-field HUC watersheds containing the proposed CHD, with slightly more than half of that total in Idaho. The East and West Forks of the Jarbidge River originate in the Jarbidge Mountains of northeastern Nevada, flowing northward to merge about four miles north of the Idaho-Nevada border. The mainstem Jarbidge River flows northwest to its confluence with the Bruneau River, which then flows northward to enter C.J. Strike Reservoir on the Snake River.

The area encompassing the Jarbidge and Bruneau Rivers is arguably among the most geographically remote in the continental United States. Located in the northern Great Basin, the terrain is generally rugged and mountainous with narrow valleys, ranging in elevation from 2,501 feet at the city of Bruneau, Idaho, to 10,839 feet in the Jarbidge Wilderness in Nevada. The climate is arid, with annual precipitation of 7 to 14 inches. Land cover consists of sagebrush and high desert grasses, willow lined streams, and light conifer forest in the higher elevations.

4.1.2 POPULATION CHARACTERISTICS AND DEMOGRAPHICS

The proposed CHD for the Jarbidge River population of bull trout spans two counties, Owyhee County in Idaho and Elko County in Nevada. Table 91 presents the population size, change in population from 1990 to 2000, per capita income, and poverty rates for the two counties with CHD within their boundaries, and the two relevant states. Owyhee County accounts for less than one percent of Idaho's total population, with slightly more than 11,000 residents. Elko County is the fifth largest county in the State of Nevada, with just over 44,000 people, or two percent of the State's population.

Both counties experienced strong population growth between the 1990 and 2000 Censuses. The population of Owyhee County grew by nearly 27 percent over that time period, which was only slightly less than the 28.5 percent growth rate for Idaho State. Elko County's population increased by over 35 percent in that same time period, while the State of Nevada grew at a much greater rate, 66 percent. Per capita income for Owyhee County is $17,251, somewhat less than Idaho State's figure of $24,506, and had a poverty rate of 17 percent, greater than the 11.2 percent rate of the State. Per capita income for Elko County is $24,703, which falls below the per capita income for the State of Nevada, which is $30,128. The poverty rate in Elko County is under eight percent, somewhat less than the State average of just over nine percent.

Table 91
Socioeconomic Profile of Counties Containing Proposed Critical Habitat for the Jarbidge River Population of the Bull Trout

County/State	Population (2003)	Percent of State (2003)	Change (1990-2000)	Per Capita Income (2001)	Poverty Rate (2000)
Owyhee County	11,186	0.8%	+26.8%	$17,251	17.1%
Idaho State	**1,366,332**	**100.0%**	**+28.5%**	**$24,506**	**11.2%**
Elko County	44,094	2.0%	+35.1%	$24,703	7.7%
Nevada State	**2,241,154**	**100.0%**	**+66.3%**	**$30,128**	**9.4%**

Sources:
2003 population estimates: U.S. Census Bureau, "Annual Population Estimates 2000-2003," downloaded from http://eire.census.gov/popest/data/counties/CO-EST2003-01.php, May 11, 2004.
2000 poverty estimates: U.S. Census Bureau, "Small Area Income and Poverty Estimates," downloaded from http://www.census.gov/hhes/www/saipe/estimatetoc.html, May 12, 2004.
1990-2000 population change: U.S. Census Bureau, "Ranking Tables for Counties," downloaded from http://www.census.gov/population/www/cen2000/phc-t4.html, May 12, 2004.
2001 per capita income: U.S. Department of Commerce, Bureau of Economic Analysis, May 2003, *Regional Economic Information System 1969-2001*, CD-ROM.

4.1.3 EMPLOYMENT

Recent employment data for the two counties containing proposed CHD for the Jarbidge River population of bull trout are presented in Table 92. Employment figures for each industry group are presented in terms of the number of jobs, which includes both full-time and part-time employment, and as a percentage of the total jobs within each county.

Total employment in Owyhee County is 3,886, and a large portion of this employment is related to agricultural production. Over 1,000 jobs, or nearly 28 percent of total county employment, are in agricultural production, and mainly connected with irrigated agriculture and cattle ranching. Total employment in Elko County is 23,688, and a significant industry in terms of employment is the leisure and hospitality sector, which accounts for nearly 30 percent of the jobs in the county.

Table 93 shows the earnings from employment by industry group for the two counties containing proposed CHD for the Jarbidge River population of bull trout. In Owyhee County, 38 percent of the earnings are from jobs directly related to agricultural production. The leading industry in terms of earnings for Elko County is government, which contributes nearly 23 percent of total county earnings.

Table 92
Employment Profile of Counties Containing Proposed Critical Habitat for the Jarbidge River Population of Bull Trout (Number of Jobs and Percentage of Total Jobs)

		Owyhee, Idaho	Elko, Nevada
	Total Employment	**3,886**	**23,688**
Goods Producing:	Agricultural Production (Farm)	1,067 *(27.5%)*	798 *(3.4%)*
	Forestry, Hunting, Fishing, and Related Activities[a/]	(D)	169 *(0.7%)*
	Mining	(D)	1,295 *(5.5%)*
	Construction	281 *(7.2%)*	1,303 *(5.5%)*
	Manufacturing	159 *(4.1%)*	241 *(1.0%)*
Service Providing:	Trade, Transport, and Utilities[b/]	(D)	3,980 *(16.8%)*
	Leisure and Hospitality[c/]	(D)	7,024 *(29.7%)*
	Financial Activities[d/]	(D)	1,131 *(4.8%)*
	Information	30 *(0.8%)*	233 *(1.0%)*
	Professional and Business Services[e/]	(D)	1,428 *(6.0%)*
	Educational and Health Services[f/]	(D)	1,429 *(6.0%)*
	Other Services	131 *(3.4%)*	907 *(3.8%)*
	Government	690 *(17.8%)*	3,750 *(15.8%)*

(D) not shown to avoid disclosure of confidential information; estimates for this item are included in the totals
a/ also includes Agricultural Services
b/ includes Utilities, Transportation and Warehousing, Retail Trade, and Wholesale Trade
c/ includes Accommodation and Food Services, and Arts, Entertainment, and Recreation
d/ includes Finance and Insurance, and Real Estate and Rental and Leasing
e/ includes Professional, Scientific, and Technical Services, Administrative Support, Waste Management, and Remediation Services, and Management of Companies and Enterprises
f/ includes Education Services and Heath Care and Social Assistance
Source: U.S. Department of Commerce, Bureau of Economic Analysis, May 2003, *Regional Economic Information System 1969-2001*, CD-ROM.

Table 93
2001 Earnings from Employment in Counties Containing Proposed Critical Habitat for the Jarbidge River Population of Bull Trout
(Millions of Dollars and Percentage of Total Earnings)

		Owyhee, Idaho	Elko, Nevada
	Total Employment	**$93.2**	**$727.5**
Goods Producing:	Agricultural Production (Farm)	$35.5 *(38.1%)*	$15.4 *(2.1%)*
	Forestry, Hunting, Fishing, and Related Activities[a/]	(D)	$1.8 *(0.2%)*
	Mining	(D)	$84.9 *(11.7%)*
	Construction	$8.7 *(9.3%)*	$53.5 *(7.4%)*
	Manufacturing	$4.6 *(4.9%)*	$5.5 *(0.8%)*
Service Providing:	Trade, Transport, and Utilities[b/]	(D)	$122.0 *(16.8%)*
	Leisure and Hospitality[c/]	(D)	$153.2 *(21.1%)*
	Financial Activities[d/]	(D)	$23.8 *(3.3%)*
	Information	$1.0 *(1.0%)*	$7.4 *(1.0%)*
	Professional and Business Services[e/]	(D)	$35.7 *(4.9%)*
	Educational and Health Services[f/]	(D)	$41.9 *(5.8%)*
	Other Services	$1.9 *(2.1%)*	$18.1 *(2.5%)*
	Government	$18.4 *(19.8%)*	$164.3 *(22.6%)*

(D) not shown to avoid disclosure of confidential information; estimates for this item are included in the totals
a/ also includes Agricultural Services
b/ includes Utilities, Transportation and Warehousing, Retail Trade, and Wholesale Trade
c/ includes Accommodation and Food Services, and Arts, Entertainment, and Recreation
d/ includes Finance and Insurance, and Real Estate and Rental and Leasing
e/ includes Professional, Scientific, and Technical Services, Administrative Support, Waste Management, and Remediation Services, and Management of Companies and Enterprises
f/ includes Education Services and Heath Care and Social Assistance

Source: U.S. Department of Commerce, Bureau of Economic Analysis, May 2003, *Regional Economic Information System 1969-2001*, CD-ROM.

4.1.4 TRIBES IN THE JARBIDGE RIVER REGION

There are no tribal lands adjacent to the proposed critical habitat within the Jarbidge River population.

4.2 REGULATORY ENVIRONMENT

This section provides relevant information about the regulatory elements that exist in the absence of listing or CHD for the bull trout. Where proposed activities directly affect proposed critical habitat areas, these regulations may provide a level of protection to the species even in the absence of ESA section 7. Furthermore, these regulations may influence development and/or affect the section 7 consultation process.

4.2.1 OTHER SPECIES LISTED UNDER THE ACT

The Service maintains lists of threatened and endangered species, and organizes the list by state (http://ecos.fws.gov/tess_public). For Nevada, there are 30 listed animals, including 22 fishes, and 8 plant species. In Idaho, the listed species include 19 animals, of which 6 are fishes, and 4 plant species.[339] Some of the species are listed in both states. The only other listed species known to occur occasionally in the Jarbidge River watershed is the bald eagle (*Haliaeetus leucocephalus*), but the primary focus of species protection in the watershed is associated with bull trout.[340]

4.2.2 FEDERAL AND STATE STATUTES AND REGULATIONS

Federal statutes that are particularly applicable to this analysis include the CWA (discussed above in Section 3.2.2.3), INFISH (Inland Native Fish Strategy) program of the USFS and BLM, and the Wilderness Act. There are no HCPs associated with the Jarbidge River population of bull trout.

4.2.2.1 INFISH (Inland Native Fish Strategy)

The USFS and the BLM presently manage fish habitat within the inland Northwest under the INFISH program. INFISH provides for the protection of areas that could contribute to the recovery of fish and improve riparian habitat and water quality throughout the basin. These objectives are accomplished through such activities as closing and rehabilitating roads, replacing culverts, changing grazing and

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339 U.S. Fish and Wildlife Service, "Threatened and Endangered Species database System (TESS)," http://ecos.fws. gov/tess_public/TESS, accessed July 2, 2004.

340 Personal communication with Service Biologist. Nevada Fish and Wildlife Office, Reno, Nevada, September 14, and December 1, 2004.

logging practices, and replanting native vegetation along streams and rivers. The USFS and the BLM also provide funds and technical expertise for restoration projects on private lands. Field offices work with local watershed councils and groups to plan and carry out priority restoration projects on both Federal and non-Federal lands. Additional details about the implementation of INFISH are provided below in Section 4.3.

4.2.2.2 The Wilderness Act

Congress created the National Wilderness Preservation System from lands already administered by the Federal government through the Wilderness Act of 1964. The purpose of the Wilderness Act was to "secure for the American people of present and future generations the benefits of an enduring resource of wilderness." The upper portion of the Jarbidge River proposed bull trout critical habitat is located within the Jarbidge Wilderness. Congress specified the uses of wilderness to be recreational, scientific, educational, historical, and for conservation. In general, extractive activities such as timber harvesting are generally prohibited by the act, although certain activities that occurred prior to the designation of wilderness, such as grazing or mining, may be allowed to continue. Grazing and mining on existing valid mineral claims are grandfathered into the Jarbidge Wilderness. About 40,000 acres in the Jarbidge Wilderness are closed to grazing; not all of this acreage is in bull trout habitat.[341]

4.2.3 Elements of the Recovery Plan

The Jarbidge River population of bull trout was listed as threatened under the Endangered Species Act on April 8, 1999 (U.S. Fish and Wildlife Service, 2004). A draft recovery plan has been prepared for the Jarbidge River population, and includes goals and objectives, a description of limiting factors, recovery actions, and an implementation schedule. Several elements of the recovery plan are described below.

This population includes the Jarbidge River watershed; bull trout occur in a single core area in the watershed. Local populations under existing and recovered conditions include: West Fork Jarbidge River, Pine Creek, Jack Creek, East Fork Jarbidge River, Slide Creek, and Dave Creek.

Contributing factors for the past decline of the Jarbidge River population of bull trout were numerous. Current limiting factors include: water temperatures, large woody debris removal, livestock grazing, transportation, isolation and habitat fragmentation within the core area, recreational fishing, and random naturally-occurring events, such as landslides and floods.[342]

Recovery goals include the following.

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[341] Personal communication with Service Biologist, Nevada Fish and Wildlife Office, Reno, Nevada, July 30, 2004.

[342] Personal communication with Service Biologist, Nevada Fish and Wildlife Office, Reno, Nevada, December 1, 2004.

1. Maintain current distribution of bull trout within the Jarbidge River Core Area and expand distribution within existing local populations.

2. Maintain stable or increasing trend in abundance of both resident and migratory bull trout in the Jarbidge River Core Area.

3. Restore and maintain suitable habitat conditions for all bull trout life history stages and strategies.

4. Conserve genetic diversity and increase natural opportunities for genetic exchange among bull trout local populations and migratory fish within the Jarbidge River Core Area.

Recovery of bull trout will involve implementing seven categories of actions, which are prioritized and listed in detail in Appendix C of the technical draft of the recovery plan (USFWS 2004). The first category of actions focuses on protecting, restoring, and maintaining suitable habitat conditions for bull trout. A few sample actions are given below.

Reducing sediment delivery to streams. Poorly designed or located roads provide sources of soil movement into adjacent rivers and streams and can have an adverse effect on water quality and riparian habitat. To address this issue, the recovery plan suggests actions to reduce sediment delivery including maintaining and repairing roads (including culverts and stream crossings) using recognized Best Management Practices. On a case-by-case basis, the Service suggests repairing, relocating, or removing roads susceptible to bank failure or other erosion issues. In addition, livestock management plans are encouraged to prevent sediment delivery to adjacent waterways and, where possible, fire suppression techniques are suggested as a means to reduce sediment delivery to streams, particularly in drought conditions (e.g., utilize existing roads, minimize construction of new roads).[343]

Assessing and reducing nutrient delivery to streams. This action can involve modifying grazing practices in livestock allotments, such as fencing to prevent cattle from entering riparian areas.

Determining effects of water withdrawals on stream temperatures and flows. Water withdrawals could occur to support mining drilling operations, to transport water to livestock allotments, to convey water to a recreation area, of for the purpose of fire suppression.

Implementing these types of actions will affect costs for projects proposed on USFS and BLM lands. Each project has a list of conservation activities (also known as mitigation activities) that are required to be implemented at the time of project construction.

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343 Nevada Fish and Wildlife Office, *Biological Opinion on the Bureau of Land Management's Ongoing Activities in the Jarbidge River Watershed in Owyhee County, Idaho and Elko County, Nevada*. November 17, 2004. File No. 1-5-03-F-114.

4.3 EFFECTS ON ROAD MAINTENANCE AND TRANSPORTATION

The Jarbidge area is one of the most sparsely populated locations in the lower 48 states. The community of Jarbidge has 12 permanent, year round residents.[344] There are two unpaved roads that provide direct access to Jarbidge. One road is an 18 mile dirt road that accesses the community from Murphy Hot Springs, Idaho, to the north. The Charleston-Jarbidge Road, also referred to as the Elko cutoff, links the town of Jarbidge with Elko, Nevada. Another road, River Ranch Road, provides indirect access to Jarbidge as it connects Interstate 80, just east of Wells, Nevada, with the Charleston-Jarbidge Road. Other unpaved access routes that connect the two main direct routes also exist, such as the Deer Creek Grade and Buck Creek Road.

The Jarbidge Canyon Road parallels the West Fork Jarbidge River for much of its length. It includes at least seven undersized bridges, and maintenance of the roads and bridges requires channel and floodplain modifications that affect bull trout habitat. In 1995, debris torrents from a storm washed out a portion of the upper Jarbidge Canyon Road above Pine Creek. The Service recommended that the road segment be closed and that a trail be maintained to reduce the effects of the road and its maintenance on the river. Periodic channelization of the river by unauthorized parties has taken place, to the detriment of bull trout, without oversight by the USACE CWA 404 permit process. The Humboldt National Forest has been unable to control trespass on some closed Federal roads.[345]

4.3.1 BASELINE CONDITIONS FOR ROAD USE

Traffic count data from the Nevada Department of Transportation (NDOT) for two of the roads leading to Jarbidge are presented in Table 94: 1) Charleston-Jarbidge Road (NDOT Station No. 365), and 2) River Ranch Road (NDOT Station No. 369). Traffic count information for the road that accesses Jarbidge from Idaho is not available. Average daily traffic counts for Charleston-Jarbidge Road, which runs east-to-west between SR-225 in the west and River Ranch Road in the east, have remained constant since 1996. Data from the USFS Jarbidge Road EIS indicate use on the Jarbidge-Charleston Road increases to 30 vehicles per day during hunting season. For traffic on River Ranch Road, which runs north-south from I-80 in the south past Jarbidge in the north, average daily traffic levels remained constant at 20 vehicles per day, but then dropped to 10 vehicles per day beginning in 2002.

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344 Personal communication with Butch Smith, Jarbidge Community Advisory Board, May 18, 2004.

345 U.S. Fish and Wildlife, June 10, 1998, "Endangered and Threatened Wildlife and Plants: Proposal to List the Coastal-Puget Sound, Jarbidge River, and St. Mary-Belly River Population Segments of Bull Trout as Threatened Species," *Federal Register*, Vol. 63, No. 111, p. 31705.

Table 94
Average Annual Daily Vehicle Counts for Jarbidge Access Routes in Nevada

Year	Station No. 365 (Charleston-Jarbidge Rd. a.k.a. Elko cutoff)	Station No. 369 (River Ranch Road)
1993	15	20
1994	40	10
1995	25	20
1996	40	20
1997	40	20
1998	40	20
1999	40	25
2000	40	10
2001	40	10*
2002	40	10*

Notes: * Data estimated; data collected for seven consecutive days per year and adjusted with other daily NDOT data to adjust for State and county-wide use. This approach is based in sample methodology, not use census (personal communication with David Leegard, Nevada Department of Transportation, June 1, 2004).

Source: Nevada Department of Transportation, Elko 2002 Traffic Counts, http://www.nevadadot.com/reports_pubs/traffic_report/2002/.

4.3.2 Effects on Road Building Activities

There has been one road improvement project completed in the Jarbidge area on Federal lands affecting bull trout since 1998, in addition to ongoing maintenance. The road improvement project for Pole Creek Road provided gravel cover on portions of the 18 mile road in order to reduce sediment delivery to streams.[346] In addition, the USFS has prepared a draft environmental impact statement (DEIS) that addresses the need for road construction in Jarbidge Canyon. The purpose and need of the Jarbidge Canyon DEIS is to "provide access within the West Fork of the Jarbidge River Canyon to the Jarbidge Wilderness while improving the environment and aquatic habitat and conditions for the listed bull trout."[347] The following discussion provides a summary of the economic impacts associated with the effects of conservation activities for bull trout on road building activities.

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[346] Personal communication with Craig Newman, USFS Engineer, Humboldt-Toiyabe National Forest, September 10, 2004.

[347] U.S. Forest Service, April 2003, *Jarbidge Canyon Draft Environmental Impact Statement*, pp. 1-6.

The Pole Canyon Road maintenance project occurred in 1999. The objective of the project was to improve drainage and reduce sediment load from an 18.4 mile network of heavily utilized roads within the East Fork of the Jarbidge River watershed. The project was undertaken as part of the INFISH strategy to improve habitat conditions for bull trout. In addition to laying down gravel, the project involved maintenance of existing drainage, replacement of culverts and other drainage improvements (e.g., cross-drains, French drains, etc.). Expected benefits identified by the USFS include reduced sediment loading by at least 60 tons per year resulting in improved bull trout habitat.[348] The total cost of the project was $345,000 (in 2004 dollars).[349] Because the project was designed specifically for bull trout habitat improvement, this analysis includes the total cost of the project in the calculation of retrospective costs (Table 96).

The Jarbidge Canyon DEIS provides an historic summary of the road management activity and ensuing legal actions. This DEIS was recently finalized and has implications for the level of road construction and maintenance activity during the next decade. The EIS presents seven alternatives, five of which involve road construction for the south Canyon Road. Preliminary total project cost estimates for the alternatives are listed in Table 95. Alternative 3 was the selected course of action.

Table 95
South Canyon Road Costs ($1,000s) by Alternative[a/]

Cost Item	Alt. 2A	Alt. 2B	Alt. 3	Alt. 4	Alt. 5A	Alt. 5B	Alt. 6A	Alt. 6B
Reclamation preparation	120	120	253	111	126	776	158	870
Reclamation erosion control and planting	78	78	10		1	1	14	14
Construction preparation	27.6	91	91	25	32	80	94	94
Grading	78	142	142	50	278	124	410	187
Structures			1,947	884	200	6,800	50	7,400
Erosion control and planting			74	94	80	89	107	107
Totals	**339**	**404**	**3,348**	**1,547**	**952**	**10,467**	**1,108**	**11,534**

[a/] Costs were not provided for Alternatives 1 and 7 since there is not any proposed road construction for the South Canyon Road.

348 U.S. Forest Service, "1999 Ten-Percent Fund Project Summary: Upper East Fork Jarbidge Watershed Road Enhancement (Pole Creek Road). Fax communication with Craig Newman, USFS Engineer, Humboldt-Toiyabe National Forest, September 10, 2004.

349 Cost of project was $312,000 in 1999, inflated using the GDP deflator. Actual length of road gravel was approximately nine miles. Annual maintenance costs are minimal ($1,500). Personal communication with Craig Newman, USFS Engineer, Humboldt-Toiyabe National Forest, September 10, 2004.

Considering the present alternatives and associated costs, the improvements afforded by Alternatives 2, 5, and 6 involve new road construction designed in part to avoid riparian habitat disturbance.[350] In fact, the DEIS includes a section dedicated to the discussion of alternative selection on bull trout habitat. Compared to Alternative 1 (the baseline scenario), these three provide the most benefit to bull trout habitat. Alternative 3 would also improve overall aquatic health, but not to the same degree as the Alternatives mentioned above. Only Alternative 4 provides no additional benefit to bull trout habitat.

In the extreme, the marginal cost associated with Alternatives 2, 3, 5 and 6 relative to Alternative 4 (no improvement) could be attributed to bull trout. This is based on the assumption that project work was spurred initially by the need for improving, repairing, and maintaining road conditions, but that selection of a specific action is driven by bull trout habitat concerns. This difference in cost between Alternative 4 and 3 amounts to $1.8 million in total road construction cost. By assuming a 50-year life for the roads, a 20-year prospective cost period, and seven percent discount rate, the total prospective cost attributable to bull trout is $382,000 (see Table 96).

Table 96
Summary of Road Maintenance and Transportation Costs

Category	Retrospective (Total)	Prospective (Total)		Prospective (Annualized)
		3%	7%	
Total Road Maintenance and Transportation Cost	$344,000	$536,000	$382,000	$36,000

4.4 EFFECTS ON AGRICULTURE AND GRAZING

Grazing activities began in the Jarbidge River Basin in the late 1800s and continues to be a major land use activity. Livestock grazing can degrade bull trout habitat primarily through water quality impacts resulting from increased soil erosion, stream channel modification, and removal of riparian vegetation. There have been five consultations with the BLM and USFS specifically dealing with livestock grazing on Federal land since bull trout were listed. In addition, several consultations have involved USFS and BLM management plans and included grazing activities as one component. In November 2004, the BLM and USFS completed a consultation regarding ongoing activities within the Jarbidge River Watershed.[351]

As shown in Table 97, nearly 253,000 acres are contained within grazing allotments located adjacent to the Jarbidge. Of this, the vast majority is under Federal ownership, including both BLM and USFS land. BLM lands are generally in the lower portions of the watershed where bull trout are known to migrate.

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[350] Alternative 4 is the only one unlikely to improve aquatic habitat.

[351] Nevada Fish and Wildlife Office, *Biological Opinion on the Bureau of Land Management's Ongoing Activities in the Jarbidge River Watershed in Owyhee County, Idaho and Elko County, Nevada*. November 17, 2004. File No. 1-5-03-F-114

USFS lands are generally in the higher elevation portions of the watershed where bull trout are known to spawn.[352]

Table 97
Grazing Allotments by Ownership in the Jarbidge Watershed (Acres)

Allotment	Federal	State	Private	Total	Affects CHD[a/]
BLM Allotments					
Seventy-One Desert	40,290	1,921	0	42,211	Yes
Crawfish	10,650	640	9	11,299	Yes
Taylor Pocket	17,000	150	1,094	18,244	Yes
Black Rock Pocket	11,900	830	220	12,950	Yes
Wilkins Island	7,620	109	6,328	14,057	Yes
Diamond A	110,120	6,280	13,740	130,140	Yes
Poison Butte	65,100	3,150	4,450	72,700	Yes
Inside Desert	105,900	5,770	4,200	115,870	No
USFS Allotments					
Buck Creek	15,512	-	173	15,685	Yes
Dave Creek	10,970	-	-	10,970	Yes
Pole Creek	7634	-	-	7,634	Yes
Robsinson Hole	3446		160	3,606	Yes
Guerry Sheep[b/]	5300	-	-	5,300	Yes
Spring Creek				- [C/]	Yes
Total	**411,442**	**18,850**	**30,374**	**460,666**	**344,796**[d/]

a/ Allotments that impact critical habitat are those with at least a portion of the grazing allotment within a fifth-field HUC watershed and are required through INFISH to implement grazing-related conservation measures. Although the Service identifies the Black Rock Pocket, Crawfish, Inside Desert, Seventy-One Desert, and Taylor Pocket Allotments as unlikely to adversely affect bull trout critical habitat based on their location within the watersheds, this analysis assumes they are still required to follow IMFISH grazing related conservation measures (Identification of adjacent watersheds assisted through personal communication with Service Biologist, Nevada Fish and Wildlife Office, Reno, Nevada, October 14, 2004).

b/ The Guerry Sheep allotment that falls within the East Fork Jarbidge River watershed includes only a portion of Raker Creek.

c/ Acreage totals for Spring Creek not reported in USFS BA.

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352 Personal communication with Service Biologist, Nevada Fish and Wildlife Office, Reno, Nevada, September 14, 2004.

d/ Total acreage that impacts critical habitat includes the acreage of allotments found on the mainstem Jarbidge River or direct tributaries as determined by the biological assessments completed by the BLM and USFS.

Sources: Klott, J., and T. Burton, February 27, 2003, "Biological Assessment for Bull Trout on the Ongoing Activities in the Jarbidge River Watershed," BLM, Jarbidge Field Office; Blattel-Sam, Lori, and Jim Harvey, March 31 2003, "Biological Assessment for Bull Trout on the Ongoing Activities in the Jarbidge River Watershed," USFS, Humboldt-Toiyabe National Forest.

The Service issued a Biological Opinion on BLM's Jarbidge Resource Area Resource Management Plan in 2001 and the USFS Land and Resource Management Plan for the Humboldt National Forest in 2003. The BOs established standards and monitoring requirements for grazing on BLM and USFS land that may affect streams containing bull trout. The BO required the BLM and USFS to develop and implement grazing management plans and review, modify, and implement annual operating instructions to meet the objectives established by the Inland Native Fish Strategy for the Intermountain, Northern, and Pacific Northwest Regions (INFISH).

The following standards and guidelines were outlined in INFISH:

1. Modify grazing practices (e.g., accessibility of riparian areas to livestock, length of grazing season, stocking levels, timing of grazing, etc.) that retard or prevent attainments of Riparian Management Objectives or are likely to adversely affect inland native fish. Suspend grazing if adjusting practices is not effective in meeting Riparian Management Objectives.

2. Locate new livestock handling and/or management facilities outside of Riparian Habitat Conservation Areas. For existing livestock handling facilities inside the Riparian Habitat Conservation Areas, assure that facilities do not prevent attainment of Riparian Management Objectives. Relocate or close facilities where these objectives cannot be met.

3. Limit livestock trailing, bedding, watering, salting, loading, and other handling efforts to those areas and times that would not retard or prevent attainment of Riparian Management Objectives or adversely affect inland native fish.

4. Adjust wild horse and burro management to avoid impacts that prevent attainment of Riparian Management Objectives or adversely affect inland native fish.

INFISH was originally implemented as an interim strategy by BLM in 1995 according to Instruction Memorandum No. OR-96-010 and was referred to as the "Interim Bull Trout Habitat Conservation Strategy" as part of the Interior Columbia Basin Ecosystem Management Project (ICBEMP). INFISH provided programmatic direction for management of lands administered by the BLM and USFS for the protection of native fish populations including bull trout. The ICBEMP process led to a memorandum of understanding between the USFS, BLM, Service, NOAA, and EPA to use information developed in the project to update land use plans. The Biological Opinion issued to the BLM makes continued implementation of INFISH binding on the agency. Because this BO authorizes the specific activities initially called for in the interim strategy, it is assumed that the associated costs are relevant to the time frame established for this analysis.

The possible management actions identified in the BO include changing the number of animals allowed on a pasture, changing the timing and duration of grazing, herding, fencing of riparian areas, and developing upland water sites to keep cattle away from riparian areas. To date, a variety of management actions have been implemented including some limited fencing of riparian areas, reduction in the grazing season length on some pastures adjacent to bull trout spawning habitat, and increased monitoring of stubble height and utilization rate standards. The allowable AUMs have not been reduced on any pasture to protect bull trout.[353]

The Interagency Implementation Team, created as part of INFISH, developed a categorization process for grazing areas. The categories were used to prioritize monitoring efforts on USFS and BLM land.

- Category I. All USFS/BLM pasture/use areas with riparian areas that lie entirely or partially within a 6th-field HUC/subwatershed that have fish species listed under the Act (salmon, steelhead, or bull trout) or designated/proposed critical habitat.

- Category II. All USFS/BLM pasture/use areas with riparian areas that lie entirely or partially within a 6th-field HUC/subwatershed that do not contain fish species listed under the Act (salmon, steelhead, or bull trout) or designated/proposed critical habitat within the 6th-field HUC/subwatershed.

- Category III. All USFS/BLM pasture/use areas that do not have riparian areas.

According to the Biological Opinions issued on the implementation of INFISH, a minimum four inch residual stubble height is required in riparian areas within Category I and II streams while Category III pastures allow a maximum 50 percent utilization rate.[354] Once the stubble height minimum or utilization rate is reached, all livestock must be removed from the pasture.

Grazing permit holders have generally been able to adjust grazing strategies to accommodate the season reduction and have not, in most cases, incurred a reduction in AUMs.[355] Stubble height minimums and utilization rate standards have forced permit holders to increase livestock monitoring activities, however. In general, livestock managers have had to increase riding on affected pastures in order to move cattle from riparian areas to upland areas to avoid "triggering" cattle removal due to forage restrictions in riparian areas.

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[353] Personal communication with Jim Klott, Wildlife Biologist, Bureau of Land Management, Twin Falls, Idaho, May 2004.

[354] Guerrero, Edward, Bureau of Land Management, Jarbidge Field Manager, April 13, 2001, Letter to Chuck Jones, Buck Creek Ranch, Inc. Nevada Fish and Wildlife Office, *Biological Opinion on the Bureau of Land Management=s Ongoing Activities in the Jarbidge River Watershed in Owyhee County, Idaho and Elko County, Nevada*. November 17, 2004. File No. 1-5-03-F-114

[355] Personal communication with Burt Brackett, private rancher, May 2004.

INFISH was officially adopted by the USFS in 1995. However, it is unclear whether grazing management was altered prior to the final listing of bull trout. In addition, BLM requested consultation on the implementation of INFISH in June 1998, which was also prior to the listing. Despite this, in this analysis, it is assumed that all conservation activities are associated with bull trout, which likely overstates the costs as the activities may not have been implemented for bull trout considerations. The following costs were identified:

1. Grazing activities on one pasture were halted in 2001 by court order until necessary studies and consultation can be completed. Although the court order did not explicitly result from the proposal of critical habitat, it was spurred by litigation driven primarily by BLM's failure to provide for adequate protection for threatened species, including bull trout.[356] The Dave Island Pasture, which is adjacent to bull trout habitat, contains approximately 3,200 acres of private land and 2,600 acres of public grazing.[357] Grazing has ceased on both private and public land in the pasture because there is currently no fencing to restrict livestock movement. Assuming the pasture provides 0.27 AUMs per acre, the court order has resulted in an estimated loss of 1,562 AUMs each year.[358] This reduction in available forage has forced the permit holder to locate alternative feed sources on private grazing land.[359] The difference in total grazing costs between private rangeland and grazing Federal land has been estimated to be $16.38 per AUM.[360] Applying this value to the foregone feed results in an annual value of $25,578. To apportion these costs to HUC watersheds, the analysis assumes Dave Island pasture falls evenly on three HUCs within the designation – Jarbidge River, Middle Jarbidge, and Poison Creek (see Map 3 in the Map Attachments).

2. Two relatively small fences have been constructed in an effort to keep cattle from streams containing bull trout. The BLM constructed approximately two miles of fence on Columbet Creek and the USFS constructed some riparian fencing within the Dave Creek Allotment. The total construction cost of these fences was estimated to be $26,000, or approximately $5,200 per year.[361] No future projects are currently being planned and fencing projects are expected to

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[356] Personal communication Jim Klott, Wildlife Biologist, Bureau of Land Management, Twin Falls, Idaho, September 10, 2004. In November 2004, the Service's Biological Opinion explicitly prohibits grazing on Dave's Island Pasture.

[357] Klott, J., and T. Burton, February 27, 2003, "Biological Assessment for Bull Trout on the Ongoing Activities in the Jarbidge River Watershed," Bureau of Land Management, Jarbidge Field Office.

[358] The BLM portion of the Dave Island Pasture provides approximately 700 AUMs per year from 2,600 acres, or 0.27 AUMs/acre. Personal communication with Chet Bracket, private rancher, May 2004.

[359] Personal communication with Chet Brackett, private rancher May 2004.

[360] Torell, L. A., E. Bruce Godfrey, and D. B. Nielsen, January 1986, "Forage Utilization Cost Differentials in a Ranch Operation: A Case Study," *Journal of Range Management,* Vol. 39, No. 1, pp. 34-39.

[361] Based upon a total fence length of four miles in Dave Creek at a cost of $4,000/mile and 1.4 miles of fence in Columbet Creek at a cost of $10,000.

remain a relatively minor activity in the future.[362] This analysis assumes that annual fencing costs continue at the past level. Fence maintenance is a minor ongoing cost that is primarily the responsibility of the Federal agency.[363] Fence maintenance costs are not considered in this analysis. To apportion these costs to HUC watersheds, the analysis assumes the costs are spread evenly among all HUCs that contain grazing allotments on a per acre basis.

3. Category I, II, and III pastures and/or allotments are assumed to bear increased planning, monitoring, and reporting costs. Costs associated with development of grazing management plans, monitoring, and reporting are estimated to average between $34,000 and $46,000 per allotment, or $0.18 and $0.25 per acre each year.[364] Costs are applied to all Federal, State, and private land immediately adjacent to the Jarbidge River and therefore likely to affect bull trout CHD. Allotments that impact critical habitat are those with at least a portion of the grazing allotment within an adjacent fifth-field HUC watershed and are required through INFISH to implement grazing-related conservation measures. Although the Service identifies the Black Rock Pocket, Crawfish, Inside Desert, Seventy-One Desert, and Taylor Pocket Allotments as unlikely to adversely affect bull trout critical habitat based on their location within the watersheds, this analysis assumes these allotments are still required to follow INFISH grazing-related conservation measures.[365] Annual costs are estimated to range from $46,000 to $63,000 per year. Retrospective costs assume that annual costs have been incurred since the bull trout was listed in 1998, with the exception of Dave Island Pasture where costs have been incurred since 2000. To apportion these costs to HUC watersheds, the analysis multiplies the per acre cost above by the number of acres of grazing allotments estimated for each HUC.[366] Table 98 provides a summary of the retrospective and prospective costs associated with grazing in Jarbidge. Total retrospective costs are estimated to range from approximately $450,000 to $580,000. Prospective costs are estimated to range from approximately $95,000 to $120,000 per year. The majority of grazing costs are located in the East Fork Jarbidge River watershed (HUC 1705010213).

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362 Personal communication with Jim Klott, Wildlife Biologist, Bureau of Land Management, May 2004.

363 The Service's Biological Opinion includes terms and conditions for grazing activities related to annual fence maintenance.

364 Using the median allotment size of 18,244 acres. Costs are based on NEA research into the costs of typical monitoring and reporting activities.

365 One comment received on the draft version of this analysis asserted that the monitoring of livestock grazing should not be included as a cost because livestock grazing does not occur in areas that support bull trout. However, this analysis assumes that monitoring of livestock grazing is a conservation effort designed, in part, to benefit bull trout and other listed fish species located down river (or down watershed) from the grazing activities. Therefore, although bull trout may not exist immediately adjacent to these grazing activities, the economic analysis assumes that downstream populations benefit from monitoring of livestock grazing and therefore include these cost estimates as relevant. Importantly, however, the monitoring of livestock grazing is expected to continue with or without the designation of critical habitat.

366 Estimation of acres of grazing allotment per HUC based on personal communication with Service Biologist, Nevada Fish and Wildlife Office, Reno, Nevada, October 14, 2004.

Table 98
Summary of Costs to Grazing

Category	Retrospective (Total)	Prospective (Total)		Prospective (Annualized)
		3%	7%	
Dave Island Pasture[a/]	$77,000	$74,000	$68,000	$26,000
Fencing Projects	$28,000	$74,000	$53,000	$5,000
Planning, Monitoring, & Reporting - Low	$347,000	$937,000	$667,000	$63,000
Planning, Monitoring, & Reporting - High	$473,000	$1,279,000	$911,000	$86,000
Total - Low	**$452,000**	**$1,085,000**	**$788,000**	**$94,000**
Total – High	**$578,000**	**$1,427,000**	**$1,032,000**	**$117,000**

a/ Assumes that the Dave Island Pasture will be available for grazing in 2007.

4.5 EFFECTS ON COMMERCIAL AND RECREATIONAL MINING OPERATIONS

Jarbidge was developed in the early 1900s as a gold mining dependent town. A gold strike in 1909 started a gold rush, and the town grew to 1200 residents at its peak (Jarbidge DEIS, 2004). Gold mining occurred from 1910 to 1932.

There currently is no mining activity in the Jarbidge area. However, a mining exploration proposal by Atna Resources (Reno, Nevada) was recently discussed with the Service staff. Potential area of mining includes the Deer Creek area.[367] The Service has submitted NEPA scoping comments on an earlier version of the proposal.[368] At this point information is not available on the specific proposal, nor are the costs associated with potential conservation activities. Since 1998, there have been only two consultations related to commercial mining activity, and the project proponent, San Antonios Resources, is no longer in the mining business, as of 2002.[369] According to the Nevada Mining Association, trends in mining have been more strongly influenced by the price of gold during the last five years than bull trout. Based on the national forest information collected on recreational and commercial mining there do not appear to be economic impacts to mining attributable to conservation activities for bull trout.

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367 Personal communication with Alan Morris, consultant to Atna Resources, Reno, NV, September 9, 2004.

368 Personal communication with Service Biologist, Nevada Fish and Wildlife Office, Reno, Nevada, September 14, 2004.

369 Global Precision Medical, Inc., September 25, 2002, "San Antonios Resources Inc. announces Company Reorganization, Name Change and Acquisition of Medical Device Technology," http://www.globalprecision medical.com/s/PressReleases.asp?ReportID=42918&_Title=San-Antonios-Resources-Inc.-announces-Company-Reorganization-Name-change-an.

4.6 EFFECTS ON RECREATIONAL VISITATION

This part of the document describes the scope of effects on the recreation environment and visitation pre- and post bull trout listing in the Jarbidge, Nevada, area. Potential effects on recreation resulting from bull trout conservation activities may include: decreased access to fishing experiences due to decreased stocking activities, decreased campground or day use area access, decreased recreation access due to road closures, and hunting activity decreases due to area or road closures.

4.6.1 DATA COLLECTION

Recreation use information was obtained through literature review of recreation-related studies and personal interviews with agency staff, residents, and business owners. Where possible, quantitative data were obtained.

These published documents reviewed included the NDOW website and the USFS Jarbidge Canyon DEIS for existing and estimated recreation use levels, and the NDOT 2002 Annual Traffic Report for traffic counts.

4.6.2 JARBIDGE RIVER AREA RECREATION BASELINE CONDITIONS

Outdoor recreation in the Jarbidge area includes wildlife viewing, bird watching, scenic viewing, car camping, primitive camping, backpacking, equestrian use, fishing, hunting, wilderness use, off highway vehicle (OHV) use, water sports, winter activities and hiking. The Jarbidge Ranger District of the Humboldt National Forest offers 243,907 acres of recreation opportunities. For residents of Elko County, Nevada, and Idaho's Magic Valley, this northern Nevada mountain range is within a two-hour drive.[370]

Jarbidge Canyon is the most popular family camping area on the Jarbidge Ranger District. One developed and several undeveloped campsites are located near Jarbidge. At present, no camping fees are charged and all sites are available on a first-come/first-served basis. Jarbidge has many hiking trails of varying difficulty with approximately 150 miles of trails on the District. The lower elevations of the canyon are accessible beginning in May and the upper elevations in June or July, depending on the year and the snowpack. The District's trail system receives the most use on holidays, especially the Fourth of July, and at the end of October during hunting season. The trails are used frequently during the rest of the summer and early fall, although the popularity of these trails is increasing.[371]

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370 Wildernet, "Nevada: Jarbidge Ranger District," http://areas.wildernet.com/pages/area.cfm?areaID=040902&CU_ID=1, accessed May 27, 2004.

371 Ibid.

The Jarbidge Wilderness contains 113,167 acres of rugged, glaciated, mountain terrain. There are six trail access points for the Jarbidge Wilderness. The Jarbidge Mountains form a single crest and maintain elevations between 9,800 and 11,000 feet for approximately seven miles. Eight peaks exceed 10,000 feet. There are many canyons, which provide opportunities for backcountry experiences. One unique feature is that the Jarbidge Wilderness contains a Class 1 airshed, possessing one of the last few remnants of pristine air in the nation.[372] The Jarbidge Wilderness is reported to be one of the most remote spots in the United States, and is among the least visited of all wilderness areas.[373]

The East Fork Jarbidge River has a single OHV road access and two wilderness trail access points. The West Fork has a maintained dirt road paralleling the majority of its length. It should be noted that in 1995 a spring flood washed out the upper 1.5 miles of road to the wilderness trailhead on the West Fork Jarbidge River.[374] An environmental assessment (EA) was prepared by the USFS in 1997 to analyze reconstructing the road.[375] A Finding of No Significant Impact (FONSI) was prepared following preparation of the 1997 EA. Trout Unlimited appealed this decision, citing that "…reconstruction of the road and subsequent actions proposed will impact bull trout individuals or habitat with a consequence that the action will contribute to a trend towards Federal listing or cause a loss of viability of the population or species." The Regional Forester then remanded the EA back to the Forest for further study. Several legal appeals have taken place since then, along with civilian efforts to reconstruct the road. The road has yet to be fully repaired. Currently, Pine Creek Campground is still accessible by standard passenger vehicle; beyond that point requires use of an OHV or a four-wheel drive vehicle (4WD) to travel the remaining 1.5 miles to Snowslide Gulch trailhead.[376]

There are no developed campgrounds adjacent to the Jarbidge Wilderness.[377] There are nine undeveloped managed sites (also known as concentrated use areas) that operate on a first-come/first-served basis.[378] In total, there are approximately 35 camping units.

A number of guiding companies in the region provide wilderness and whitewater experiences in the Jarbidge and Bruneau River Canyons.

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372 Ibid.

373 Wilderness.net, "Jarbidge Wilderness," http://www.wilderness.net/index.cfm?fuse=NWPS&sec=wildView&WID=274&tab=General, accessed June 5, 2004.

374 U.S. Forest Service, April 2003, *Jarbidge Canyon Draft Environmental Impact Statement*; and personal communication with Gary Johnson, Nevada Department of Wildlife, May 18, 2004.

375 U.S. Forest Service, April 2003, *Jarbidge Canyon Draft Environmental Impact Statement.*

376 Personal communication with George Boucher, Engineer (Retired), Elko County, May 18, 2004.

377 Personal communication with Service Biologist, Nevada Fish and Wildlife Office, Reno, Nevada, December 1, 2004.

378 U.S. Forest Service, April 2003, *Jarbidge Canyon Draft Environmental Impact Statement.*

4.6.2.1 Visitation Data

The USFS does not collect regular data on recreation use in Jarbidge Canyon. The USFS estimates of use in this area come from observations of field staff that drive by or maintain the recreation sites in Jarbidge Canyon.[379]

Camping season is May through the end of October, with similar peak usage periods as trail use. These peak events can overwhelm the limited capacity of the campsites, so visitors may camp on any flat, accessible ground. Local observation suggests that more than 4,000 people visited Jarbidge Canyon during 2001. In comparison, the town of Mountain City received approximately 3,500 visitors and the Ruby Mountains Wilderness received 18,500 visitors.[380] There are no data for 2000 or 2002. Table 99 displays the distribution of visitors during 2001.[381]

Table 99
Jarbidge Wilderness Visitor Distribution 2001

Month	May	June	July	August	September	October
Visitors	400	400	1,000	650	800	1,500
Peak			July 4th	Jarbidge Days*	Labor Day	Hunting Season

* A food and music festival held in the town of Jarbidge.

Source: USFS, April 2003, *Jarbidge Draft Environmental Impact Statement.*

The District provides habitat to one of the largest mule deer herds in Nevada, and was a popular hunting area prior to recent deer herd population declines. The Jarbidge Mountains have Nevada's newest elk herd; a huntable population is expected within a few years. All Nevada big game hunting is controlled and regulated by the Nevada Department of Wildlife (NDOW).[382]

4.6.2.2 Hunting and Fishing

Jarbidge area residents have expressed the belief that recreation use and visitation has somehow been affected by the bull trout listing. To examine this claim, the analysis reviews data on hunting and fishing in the area.

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379 Personal communication with Margaret Wood, Humboldt-Toyaibe National Forest, May 18, 2004.

380 U.S. Forest Service, April 2003, *Jarbidge Canyon Draft Environmental Impact Statement.*

381 Ibid.

382 Nevada Department of Wildlife, "Hunting," http://www.ndow.org/hunt/, accessed June 5, 2004.

The NDOW issues a finite number of deer tags (hunting permits) for a given year. The number of deer tags issued is based not on recreation demand, but on biological assessment of the populations and species capacity to sustain healthy numbers. Data indicate that the peak year for number of deer tags issued was 1999 (4,381), with similar numbers of permits provided in 2000 (Table 100). A significant decrease in the number of tags issued occurred in 2002, recovering slightly in 2003.

Idaho Fish and Game (IDFG) also determine the number of deer tags issued based on biological assessment of the population. Data were only available from 2000 through 2003 and indicate a fairly stable controlled harvest of deer each year (Table 100).

Table 100
Summary of Deer Tags Issued for Nevada and Idaho Hunting Units 1998–2003

Year	Adjacent Nevada Hunting Units		Adjacent Idaho Hunting Units[b/]	
	Harvest	Tags Issued	Harvest	Total Hunters
2003	136	851	228	340
2002	139	679	214	343
2001	499	3140	215	355
2000	763	4160	212	- [b/]
1999	916	4381	- [b/]	- [b/]
1998	778	4074	- [b/]	- [b/]

Hunting Units in Nevada include 071 and 072. Units in Idaho include 40-1, 40, and 42.

[a/] Idaho hunting statistics based on "controlled deer hunt"

[b/] Data unavailable for certain years. Source: Idaho Fish and Game; Nevada Department of Wildlife.

Rainbow and bull trout are found in Canyon Creek, the West Fork and East Fork Jarbidge River, Slide Creek, Cottonwood Creek, and Sun Creek. In the wilderness area, Emerald Lake is home to brook trout and is often fly-fished.[383] The best time to fish is July (following run-off) through October. Trout populations are self-perpetuating; there is no stocking. Stocking of hatchery catchable rainbow trout in the West Fork Jarbidge River ended in 1998, and the limit was changed from ten trout daily to five.[384]

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383 Wildernet, "Nevada: Jarbidge Ranger District," http://areas.wildernet.com/pages/area.cfm?areaID=040902 &CU_ID=1, accessed May 27, 2004.

384 Personal communication with Gary Johnson, Nevada Department of Wildlife, May 2004. Public comment received on a draft version of this analysis from a Nevada State Assemblymen asserted that recreation activities have been impacted by the listing of bull tout, as evidenced by the fact that the Nevada Department of Wildlife is no longer able to stock rainbow trout. However, this economic analysis concludes that the decisions related to the stocking of rainbow trout populations is unrelated to the listing and critical habitat of the bull trout. Research done during the development of this analysis indicated that the decrease in the stocking of rainbow trout was due to decreased recreational activity in the area and was independent of the bull trout.

Season is open year around, any hour of the day or night. The limit is five trout and ten mountain whitefish, and possession of bull trout is prohibited. Following the listing of bull trout, anglers were instructed to release all of those caught.

Data provided by the NDOW suggests that during the 1970s and 1980s, the combined East Fork and West Fork of the Jarbidge River received higher use than more recent years (Table 101). Based on annual angler mail surveys that sample ten percent of licensed Nevada anglers, use figures are available and were provided for 1970 to 2002 for the West Fork and East Fork of the Jarbidge River. Key points in Table 101 include a decline in angling for three decades on the West Fork and East Fork Jarbidge River prior to the bull trout listing. Per year for each decade, the 1970s, 1980s, and 1990s had 4,082, 3,091, and 2,208 average annual users, respectively. The decrease in average annual use from the 1970s to the 1980s was 24 percent; from the 1980s to the 1990s use decreased by approximately 29 percent. Following the 1998 bull trout listing, angling on the West Fork and East Fork Jarbidge River decreased by 46 percent (average 1999 to 2002 compared with average 1990s years). Thus, use steadily has declined since the 1970s with the largest decrease in angling effort occurring from 1999 to 2002.

Angler data from IDFG were not available.[385]

Review of angler licenses sold in Owyhee County, ID, and Elko County, NV, over the last 6 to 8 years indicate a generally stable trend, with a slight peak in the late 1990s and a slightly noticeable decline in 2001 and 2002.[386] These slight declines are likely the result of general year-to-year variation in recreational activity or a decrease in stocking in local rivers. Table 101 summarizes these data.

4.6.3 Results and Analysis

During the period since 1998, recreation use in the Jarbidge area has changed. Fishing and hunting use have declined, as indicated by angling and hunting data maintained by the NDOW.[387] Changes in these activities are linked to resource availability. Fishing activity has been declining in the Jarbidge area for the two decades prior to the listing of the bull trout, and may be linked to discontinued stocking of rainbow trout species. Mule deer hunting in the Jarbidge area also has declined for several years. Due to an unhealthy deer population, NDOW has steadily decreased the number of deer hunting tags available for the game unit which includes the Jarbidge area. Declines in fishing are also linked to the decline in hunting, as many hunters hunt in the morning and then fish in the afternoon after returning to camp. The listing of the bull trout is unrelated to these changes in fishing and hunting use.

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385 Attempts to solicit Idaho angler visitation data were not successful.

386 Source: Nevada Department of Wildlife, "Fishing License Sale Statistics by County," http://www.ndow.org/about/license/sales/, accessed on September 9, 2004; personal communication with Joe Kelly, Idaho Department of Fish and Game, September 19, 2004.

387 Personal communication with Gary Johnson, Nevada Department of Wildlife, May 2004.

Table 101
Angling Level of Effort for Years 1970 to 2002

Years Averaged with % Decrease in Use per Decade	Combined Angler Days on the E. F. and W. F. Jarbidge River
1970 -1979	4,082 (10 trout per day limit, W. F. Jarbidge River stocked)
1980 – 1989 (-24%)	3,091 (10 trout per day limit, W. F. Jarbidge River stocked)
1990 –1999 (-29%)	2,208 (1999 first year of bull trout catch and release, 5 trout per day limit, no trout stocking)
2000 – 2002 (-46%)	1,198 (bull trout catch and release, 5 redband trout per day limit)

Source: Personal communication with Gary Johnson, Nevada Department of Wildlife, May 2004.

Effects on other recreation activities are unclear. Some local residents believe that recreation use has declined as a result of the bull trout listing,[388] and believe that the listing decision led to a decision to discontinue fish stocking. Local residents point to several indicators as evidence: the businesses in Jarbidge are now for sale, there has been a reduction in the number of available deer tags for this area, the number of permanent residents in Jarbidge has decreased; visits to area lodging is reduced since access is limited to the Snowslide Gulch trailhead.[389]

Some residents have asserted that wilderness guides have experienced a reduction in business related to bull trout protection efforts. Based on conversation with a whitewater boating guide and a wilderness pack guide, it appears that the impact related to bull trout conservation activities is minimal. One guide noted that some recreational activities have been adjusted to avoid sensitive bull trout stream reaches, but generally felt that the listing of bull trout has not had a direct or significant effect on his guiding business.[390]

Interviews with Federal agency personnel suggest few, if any, changes in other types of recreation activities. USFS staff who maintain campgrounds in Jarbidge Canyon have not noticed changes in

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[388] Personal communication with George Boucher, Engineer (Retired), Elko County, May 18, 2004.

[389] Personal communication with Krinn McCoy, Owner, Tsawhawbitts Bed and Breakfast, May 18, 2004.

[390] Personal communication with Lowell Prunty, Owner, Jarbidge Wilderness Guide and Packing, February 11, 2005; personal communication with Peter Grubb, River Odyssey West (ROW), February 11, 2005.

visitation since 1998 at those locations,[391] nor has the BLM recreation planner for the Jarbidge area.[392] BLM staff indicated that OHV use may have actually increased since 1998. Additionally, traffic count data obtained for two of the roads that provide access to Jarbidge show very little change.[393] Data from one traffic counter for the Jarbidge-Charleston Road did not show any changes, while data from another traffic counter (Station 369, River Ranch Road) showed a slight change beginning in 1999 from 25 vehicles per day to 10 per day.

In summary, there have been documented declines in hunting and fishing levels since the time of the bull trout listing. However, changes in hunting activity are the result of declining deer herd viability, not a result of reduced or limited access to the area. Declines in fishing activity are more likely the result of a decision by NDOW to eliminate the stocking of rainbow trout. Thus, data collected for this study do not conclusively show a decrease in recreation attendance attributable to the bull trout listing.

4.7 Effects on Federal and State Agencies

Table 102 shows a summary of cost information provided by USFS, BLM, and NDOW staff relative to bull trout conservation activities. The USFS and the BLM show costs of a similar magnitude. Also included are costs for involvement of NDOW and IDFG staff, which are comparable to those expended by Federal agencies.

Table 102
Estimated Administrative Costs for Bull Trout, Jarbidge River Population

Year	BLM Consultations	BLM Monitoring	USFS Consultations	USFS Monitoring	NDOW Monitoring	IDFG Monitoring
2004	N/A	N/A	$64,000	N/A	N/A	$ 7,500
2003	$26,000	N/A	$9,600	N/A	$23,200	$ 1500
2002	$25,000	$18,000	$6,300	$18,000	$17,400	$ 1500
2001	$20,000	$15,000	$1,000	$15,000	$19,256	$ 1500
2000	$15,000	$15,000	$3,400	$15,000	$15,544	$ 7500
1999	$15,000	N/A	$8,000	N/A	$22,040	$ 1500
1998	$5,000	N/A	$1,000	N/A	$21,344	$ 1500
Totals	**$106,000**	**$48,000**	**$93,300**	**$48,000**	**$118,784**	**$ 22,500**

391 Personal communication with Margaret Wood, Humboldt-Toyaibe National Forest, May 18, 2004.

392 Personal communication with Max Yingst, Bureau of Land Management, 2004.

393 Nevada Department of Transportation, Elko 2002 Traffic Counts, http://www.nevadadot.com/reports_pubs/traffic_report/2002/.

N/A = Not Available

4.8 POTENTIAL EFFECTS ON SMALL ENTITIES

Potential effects on small entities for the Jarbidge River CHD are discussed in Appendix A to this report.

4.9 POTENTIAL EFFECTS ON ENERGY SUPPLY

Potential effects on the energy supply of the proposed CHD for the Jarbidge River population of bull trout are analyzed in Appendix A to this report.

4.10 SUMMARY AND ANALYSIS OF EFFECTS IN THE JARBIDGE RIVER REGION

Table 103 provides a summary of the economic effects due to bull trout conservation activities for each of the activities analyzed in this analysis. Retrospective costs total $1.2 million, split between roads, grazing, and agency costs. Total prospective costs are $2.0 million assuming a seven percent discount rate. Annualized prospective costs are estimated to be $192,000. Costs associated with roads and transportation improvements account for nearly half the prospective costs.

This analysis also distributes estimated economic effects by fifth-field HUC based on the geographic location of the affected activities. Costs are apportioned based on the best available information on the location of past and future road projects and existing grazing allotments. In addition, administrative costs associated with state and Federal agency bull trout monitoring and review is apportioned equally across all HUCs. Costs for activities whose project boundaries extend across HUCs and exist both in and out of proposed critical habitat are apportioned to associated HUCs proportionally by acreage. That is, per acre costs associated with grazing conservation activities are attributed to one or more of the six relevant HUCs containing proposed critical habitat and remaining acreage within the grazing allotment is apportioned to "HUCs without proposed critical habitat" (Table 104). This approach captures the full cost of conservation activities associated with grazing allotments, and maintains the relatively ranking of economic costs per HUC within the Jarbidge River population. As shown, the East Fork of the Jarbidge River contains the highest annualized economic cost.

Table 103
Summary of Economic Costs Associated with Bull Trout Conservation Activities in the Jarbidge River Proposed Critical Habitat

Category of Impact	Retrospective (Total)	Prospective (Total)		Prospective (Annualized)
		3%	7%	
Roads and Transportation	$344,000	$536,000	$382,000	$36,000
Grazing[a/]	$578,000	$1,427,000	$1,032,000	$117,000
Mining	$0	$0	$0	$0
Recreation	$0	$0	$0	$0

State and Federal Agencies	$440,000	$922,000	$657,000	$62,000
Total	**$1,362,000**	**$2,885,000**	**$2,071,000**	**$215,000**

[a/] Grazing costs are based on the high end of the cost range.

Table 104
Summary of Total Potential Economic Costs in the Jarbidge River Population by HUC

HUC Code	HUC NAME	Retrospective (Total)[a/]	Prospective (Total)		Prospective (Annualized)	Rank of Annual Costs
			3%	7%		
1705010213	East Fork Jarbidge R.	$195,000	$615,000	$454,000	$62,000	1
1705010214	Upper Jarbidge R.	$490,000	$351,000	$250,000	$24,000	2
1705010212	Middle Jarbidge R.	$131,000	$308,000	$220,000	$21,000	3
1705010210	Jarbidge R.	$126,000	$296,000	$211,000	$20,000	4
1705010215	Cowan Reservoir	$120,000	$280,000	$200,000	$19,000	5
1705010211	Poison Creek	$98,000	$220,000	$156,000	$15,000	6
N/A	HUCs without proposed CHD	$203,000	$816,000	$581,000	$55,000	n/a
TOTAL ESTIMATED PROJECT COST		**$1,362,000**	**$2,886,000**	**$2,071,000**	**$215,000**	**-**

5.1 SOCIOECONOMIC PROFILE OF THE CRITICAL HABITAT AREA

This subsection presents key economic and demographic information, including population characteristics and general economic activity, for the counties containing proposed CHD for the Saint Mary-Belly River population of bull trout (Map 4).

5.1.1 LOCATION AND GEOGRAPHY OF THE SAINT MARY-BELLY RIVER REGION

The Saint Mary-Belly River population is located in northwest Montana east of the Continental Divide. This unit encompasses the U.S. portion of the Saint Mary River drainage in its entirety and the headwaters of the Belly River drainage. The Saint Mary-Belly River population covers approximately 290,000 acres, all of which are located within Glacier County, Montana. Approximately 225,000 of these acres are within the northeastern portion of Glacier National Park, or about 22 percent of the park's total area. Most of the region consists of steep, unstable, often unvegetated slopes, with spectacular mountain lakes and lush green valleys. The Saint Mary River drainage originates along the east slopes of the Rocky Mountains, with most of the headwaters emanating from the peaks and glacial lakes of Glacier National Park. The Belly River drainage originates in glaciated lakes on the east slopes of the Rocky Mountains. Both the Saint Mary and Belly rivers flow directly north into Canada, where joining the Waterton River drainages to form the Oldman River, which eventually flows into Hudson Bay via the South Saskatchewan River system.

A major feature in the Saint Mary River drainage is a USBR storage and diversion project. Lake Sherburne is a storage reservoir located on Swiftcurrent Creek, a tributary to the Saint Mary River. Most of Lake Sherburne is within Glacier National Park, though the dam is outside park boundaries. Saint Mary Diversion, on the Saint Mary River ¾-mile downstream from Saint Mary Lake, diverts water from the Saint Mary River to the Saint Mary Canal. The Saint Mary Canal terminates in the North Fork of the Milk River. It is this diversion system, across the Hudson Bay divide, which provides supplemental water for the USBR Milk River Project.

5.1.2 POPULATION CHARACTERISTICS AND DEMOGRAPHICS

The proposed CHD for the Saint Mary-Belly River population of bull trout is confined to just one county, Glacier County, in the State of Montana. However, the economic effects are not limited to this one county, as water diversions from the Saint Mary River, used to irrigate agriculture within the Milk River Basin, may be affected by bull trout conservation activities. Therefore, these four additional Montana counties that might be affected are also included in this analysis: Blaine, Hill, Phillips, and Valley counties. Table 105 presents the population size, change in population from 1990 to 2000, per capita income, and poverty rates for the five counties potentially affected by conservation activities for the Saint Mary-Belly River population of bull trout, as well as the State of Montana as a whole.

Glacier County, the single county containing proposed CHD for the Saint Mary-Belly River population of bull trout, has a population of 13,250, which is a little over one percent of the total population for the State of Montana. The county has experienced an increase in population of just over nine percent in the period between the 1990 and 2000 Censuses. Per capita income in the county is just under $18,000, which is considerably less than the State average per capita income of $24,040. The poverty rate in Glacier County is 27 percent, which is much greater than the State figure of 13.3 percent.

Among the four counties where bull trout conservation activities are anticipated to have economic effects, Phillips County is the smallest in terms of population, with just 4,271 residents. Hill County, with 16,350 people, is the largest of these four counties. Together, the four counties are home to slightly less than four percent of the total State population. While Blaine County has experienced population growth, increasing by slightly over four percent from 1990 to 2000, the other counties have decreased in population. Phillips County has lost the most, with a decrease in population of nearly 11 percent between the 1990 and 2000 Censuses. Per capita income in the four counties ranges from $16,715 in Blaine County to $25,121 in Valley County, and only Valley County has a per capita income that is greater than the State average of $24,044. Poverty rates range from 15.2 percent in Valley County to 22.6 percent in Blaine County, and all are greater than the State average of 13.3 percent.

Table 105
Socioeconomic Profile of the Economic Region Affected by the Proposed Critical Habitat for the Saint Mary-Belly River Population of Bull Trout

County/State	Population (2003)	Percent of State (2003)	Change (1990-2000)	Per Capita Income (2001)	Poverty Rate (2000)
Blaine County	6,729	0.7%	+4.2%	$16,715	22.6%
Glacier County	13,250	1.4%	+9.3%	$17,982	27.0%
Hill County	16,350	1.8%	-5.6%	$22,848	16.8%
Phillips County	4,271	0.5%	-10.9%	$19,441	16.7%
Valley County	7,349	0.8%	-6.8%	$25,121	15.2%
Montana State	**917,621**	**100.0%**	**+12.9%**	**$24,044**	**13.3%**

Sources:
2003 population estimates: U.S. Census Bureau, "Annual Population Estimates 2000-2003," downloaded from http://eire.census.gov/popest/data/counties/CO-EST2003-01.php, May 11, 2004.
2000 poverty estimates: U.S. Census Bureau, "Small Area Income and Poverty Estimates," downloaded from http://www.census.gov/hhes/www/saipe/estimatetoc.html, May 12, 2004.
1990-2000 population change: U.S. Census Bureau, "Ranking Tables for Counties," downloaded from http://www.census.gov/population/www/cen2000/phc-t4.html, May 12, 2004.
2001 per capita income: U.S. Department of Commerce, Bureau of Economic Analysis, May 2003, *Regional Economic Information System 1969-2001,* CD-ROM.

5.1.3 EMPLOYMENT

Recent employment data for Glacier County, which contains the proposed CHD for the Saint Mary-Belly River population of bull trout, and the four counties that might experience economic impacts related to the CHD are presented in Table 106. Employment for each industry group is shown in terms of the number of jobs, both full-time and part-time, and the percentage of the total jobs for each county.

Glacier County has a total employment of 6,015, of which a large portion is found in the government sector. Over 37 percent of jobs in the county are in government. Other significant employment sectors include leisure and hospitality, and trade, communication, and utilities, and much of this is connected to tourism and recreation related to Glacier National Park.

Total employment in Blaine County is 2,908, with a large portion, 22 percent, of these jobs related to agricultural production. Also significant in terms of employment is the government sector, which is responsible for 29 percent of the jobs in the county.

Total employment in Hill County is 9,722, and the most significant employment sector is government, with 37 percent of the jobs. Agricultural production is less important in this county as only eight percent of total jobs are in this area. Trade, transportation, and utilities accounts for 14 percent of the county's employment, and leisure and hospitality contributes 15 percent.

In terms of employment, Phillips County is the smallest of the four counties, with just 2,739 jobs. Similar to Blaine County, a significant portion are in agricultural production, which is responsible for 22 percent of total jobs in the county. Government employment is less significant than the previous counties, as only 17 percent of county employment is attributed to this sector.

Valley County is also somewhat reliant on the agricultural production sector for employment, as over 18 percent of the 4,363 jobs in the county come from this sector. Trade, transportation, and utilities also contributes about 18 percent of county jobs, and government is responsible for 17 percent.

Table 107 shows the earnings from employment by industry for the same group of counties. Government is an important contributor to earnings in all counties, ranging from 24 percent of all earnings in Valley County to 51 percent of earnings in Blaine County. The trade, transportation, and utilities sector is also a significant contributor in terms of earnings among the counties.

Table 106
Employment Profile of the Economic Region Affected by the Proposed Critical Habitat for the Saint Mary-Belly River Population of Bull Trout (Number of Jobs and Percentage of Total Jobs)

		Blaine	Glacier	Hill	Phillips	Valley
	Total Employment	**2,908**	**6,015**	**9,722**	**2,739**	**4,363**
Goods Producing:	Agricultural Production (Farm)	637 *(21.9%)*	500 *(8.3%)*	788 *(8.1%)*	606 *(22.1%)*	800 *(18.3%)*
	Forestry, Hunting, Fishing, and Related Activities[1/]	(D)	(D)	103 *(1.1%)*	(D)	(D)
	Mining	(D)	140 *(2.3%)*	94 *(1.0%)*	(D)	33 *(0.8%)*
	Construction	(D)	278 *(4.6%)*	425 *(4.4%)*	100 *(3.7%)*	159 *(3.6%)*
	Manufacturing	(D)	(D)	112 *(1.2%)*	48 *(1.8%)*	94 *(2.2%)*
Service Providing:	Trade, Transport, and Utilities[2/]	(D)	820 *(13.6%)*	(D)	518 *(18.9%)*	798 *(18.3%)*
	Leisure and Hospitality[3/]	161 *(5.5%)*	894 *(14.9%)*	943 *(9.7%)*	(D)	382 *(8.8%)*
	Financial Activities[4/]	93 *(3.2%)*	190 *(3.2%)*	637 *(6.6%)*	147 *(5.4%)*	270 *(6.2%)*
	Information	(D)	31 *(0.5%)*	232 *(2.4%)*	34 *(1.2%)*	42 *(1.0%)*
	Professional and Business Services[5/]	(D)	(D)	558 *(5.7%)*	100 *(3.7%)*	226 *(5.2%)*
	Educational and Health Services[6/]	(D)	237 *(3.9%)*	(D)	(D)	(D)
	Other Services	155 *(5.3%)*	325 *(5.4%)*	519 *(5.3%)*	132 *(4.8%)*	194 *(4.4%)*
	Government	829 *(28.5%)*	2,234 *(37.1%)*	2,001 *(20.6%)*	458 *(16.7%)*	738 *(16.9%)*

(D) not shown to avoid disclosure of confidential information; estimates for this item are included in the totals
1/ also includes Agricultural Services
2/ includes Utilities, Transportation and Warehousing, Retail Trade, and Wholesale Trade
3/ includes Accommodation and Food Services, and Arts, Entertainment, and Recreation
4/ includes Finance and Insurance, and Real Estate and Rental and Leasing
5/ includes Professional, Scientific, and Technical Services, Administrative Support, Waste Management, and Remediation Services, and Management of Companies and Enterprises
6/ includes Education Services and Heath Care and Social Assistance
Source: U.S. Department of Commerce, Bureau of Economic Analysis, May 2003, *Regional Economic Information System 1969-2001*, CD-ROM.

Table 107
2001 Earnings from Employment in Counties of the Economic Region Affected by the Proposed Critical Habitat for the Saint Mary-Belly River Population of Bull Trout
(Millions of Dollars and Percentage of Total Earnings)

		Blaine	Glacier	Hill	Phillips	Valley
	Total Employment	**$55.7**	**$162.4**	**$223.5**	**$44.5**	**$102.5**
Goods Producing:	Agricultural Production (Farm)	$3.7 *(6.7%)*	$13.2 *(8.1%)*	$3.6 *(1.6%)*	$3.6 *(8.0%)*	$13.5 *(13.1%)*
	Forestry, Hunting, Fishing, and Related Activities[1/]	(D)	(D)	$1.1 *(0.5%)*	(D)	(D)
	Mining	(D)	$4.1 *(2.5%)*	$3.6 *(1.6%)*	(D)	$1.1 *(1.1%)*
	Construction	(D)	$5.8 *(3.6%)*	$8.3 *(3.7%)*	$2.1 *(4.6%)*	$5.0 *(4.9%)*
	Manufacturing	(D)	(D)	$2.6 *(1.1%)*	$0.8 *(1.7%)*	$2.0 *(2.0%)*
Service Providing:	Trade, Transport, and Utilities[2/]	(D)	$26.0 *(16.0%)*	(D)	$9.4 *(21.0%)*	$23.2 *(22.7%)*
	Leisure and Hospitality[3/]	$1.9 *(3.4%)*	$15.0 *(9.3%)*	$11.3 *(5.0%)*	(D)	$6.0 *(5.8%)*
	Financial Activities[4/]	$1.1 *(2.0%)*	$2.4 *(1.5%)*	$9.4 *(4.2%)*	$2.3 *(5.2%)*	$4.6 *(4.5%)*
	Information	(D)	$0.5 *(0.3%)*	$8.8 *(3.9%)*	$0.4 *(0.9%)*	$0.7 *(0.7%)*
	Professional and Business Services[5/]	(D)	(D)	(D)	$1.1 *(2.4%)*	$4.4 *(4.3%)*
	Educational and Health Services[6/]	(D)	$3.1 *(1.9%)*	(D)	(D)	(D)
	Other Services	$1.8 *(3.2%)*	$4.3 *(2.6%)*	$7.0 *(3.1%)*	$2.3 *(5.2%)*	$3.2 *(3.2%)*
	Government	$28.5 *(51.1%)*	$78.6 *(48.4%)*	$64.4 *(28.8%)*	$12.8 *(28.7%)*	$24.5 *(23.9%)*

(D) not shown to avoid disclosure of confidential information; estimates for this item are included in the totals
1/ also includes Agricultural Services
2/ includes Utilities, Transportation and Warehousing, Retail Trade, and Wholesale Trade
3/ includes Accommodation and Food Services, and Arts, Entertainment, and Recreation
4/ includes Finance and Insurance, and Real Estate and Rental and Leasing
5/ includes Professional, Scientific, and Technical Services, Administrative Support, Waste Management, and Remediation Services, and Management of Companies and Enterprises
6/ includes Education Services and Heath Care and Social Assistance

Source: U.S. Department of Commerce, Bureau of Economic Analysis, May 2003, *Regional Economic Information System 1969-2001*, CD-ROM.

5.1.4 TRIBES IN THE SAINT MARY-BELLY RIVER REGION

Some portions of the Saint Mary River and other streams in that basin that are proposed for designation of critical habitat are part of the Blackfeet Indian Reservation. None of the Belly River headwaters are under tribal jurisdiction. The proposed CHD includes approximately 41.9 miles of stream segments on tribal lands, or 44 percent of the total, and 2,189 acres of lakes on tribal lands, or 35 percent of the total. Tribal lands make up about 45 percent of the total lands adjacent to proposed CHD for the Saint Mary-Belly River population.

Some basic characteristics of the Blackfeet Indian Reservation and off-reservation trust lands are presented in Table 108.[394] The reservation land area is quite large, encompassing over 2,371 square miles. Nearly 90 percent of the reservation is located in Glacier County; the remainder is in Pondera County. The total population of the reservation was 10,100 in 2000, with 8,684 of these identifying their race as American Indian and Alaska Native (AIAN) alone or in combination with one or more other race. According to the Blackfeet Nation, the tribe has 15,560 enrolled members, of which approximately 7,000 live on the reservation.[395] Not all of those reporting AIAN as race are necessarily enrolled members of the Blackfeet Nation, as they may belong to other tribes. A small area of off-reservation trust lands, with a land area of just over one-tenth of a square mile, is unoccupied according to Census data.

Table 108
Land and Population Characteristics of Blackfeet Reservation and Off-Reservation Trust Lands

Blackfeet Indian Reservation	Reservation	Off-Reservation Trust Lands
Land Area (square miles)	2,371.33	0.11
Total Population (All Races)	10,100	0
American Indian and Alaska Native Population[a/]	8,684	0

a/ Includes residents of reservation or off-reservation trust lands who selected American Indian and Alaska Native (AIAN) as race, whether they selected AIAN alone or in combination with one or more other races.

Source: U.S. Census Bureau, September 2002, *Montana: 2000 Summary Population and Housing Characteristics, 2000 Census of Population and Housing,* PHC-1-28.

394 Off-reservation trust lands are lands owned by the United States and held in trust on behalf of the tribe.

395 Blackfeet Nation, January 20, 2005, http://www.blackfeetnation.com.

Table 109 presents socioeconomic characteristics for the residents of the Blackfeet Reservation, including unemployment and poverty rates and per capita income.[396] Similar data for the two counties in which the reservation is located are also presented for comparison, as well as data for the State of Montana. In this table, unemployment rate is the percentage of civilians 16 years old or older who reported that they were unemployed members of the labor force in the 2000 Census. The poverty rate is also based on 2000 Census data and represents the percentage of individuals who reported 1999 income less than a nationally-determined poverty level. Per capita income in this table is based on 1999 income reported in the 2000 Census. These data differ from those presented earlier in the socioeconomic profile for the counties in the Saint Mary-Belly River region as it was necessary to use alternative sources and years of data to obtain tribal information.

Table 109
Socioeconomic Characteristics of Blackfeet Reservation with County/State Data for Comparison

Area/Tribal Lands	Unemployment Rate (2000)	Per Capita Income (1999)	Poverty Rate (1999)
Blackfeet Reservation[a.]	22.6%	$9,751	33.8%
Glacier County	15.4%	$11,597	27.3%
Pondera County	6.9%	$14,276	18.8%
Montana State	**6.3%**	**$17,151**	**14.6%**

a/ Data are reported for the Blackfeet Reservation and off-reservation trust land, but Census data show the off-reservation trust land to be uninhabited.

Note: Per capita income and poverty data for counties presented here differs from data presented in Table 105 due to the use of different sources and years of data. The source and year of data shown here were chosen in order to obtain statistics for Indian reservations (not available from the sources used in Table 105) and allow comparison to similar data for the county and state.

Source: U.S. Census Bureau, Census 2000, Table DP-3: Profile of Selected Economic Characteristics – 2000, retrieved for each area from http://censtats.census.gov/pub/Profiles.shtml.

The unemployment rate for residents of the Blackfeet Reservation was 22.6 percent in 2000, much greater than that of the state, at 6.3 percent. High reservation unemployment contributed to a 15.4 percent unemployment rate for Glacier County, as reservation residents made up over 70 percent of the county population in 2000 (9,209 of the 10,100 reservation residents lived in Glacier County according to the 2000 Census[397]). Pondera County unemployment was more generally aligned with the state as a whole, at 6.9 percent. Per capita income for reservation residents was $9,751, or just over half of that for

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[396] Data for Indian reservations and off-reservation trust lands presented in Table 109 are based on all residents living within the boundaries of the Indian reservation or off-reservation trust lands. Therefore, all races are represented, not just the Indian population.

[397] U.S. Census Bureau, September 2002, *Montana: 2000 Summary Population and Housing Characteristics, 2000 Census of Population and Housing,* PHC-1-28, p. 118.

Montana State ($17,151). Per capita income for the two counties was $11,597 in Glacier County and $14,276 in Pondera County. While the State of Montana reported a poverty rate of 14.6 percent, the poverty rate for the reservation was more than double, at 33.8 percent. Glacier County's poverty rate of 27.3 percent is again influenced by the large portion of the county population made up of people living on the reservation. Pondera County had a poverty rate of 18.8 percent.

5.2 REGULATORY ENVIRONMENT

5.2.1 OTHER SPECIES LISTED UNDER THE ACT

The endangered pallid sturgeon occurs in the Missouri River, along the southern borders of Blaine, Phillips, and Valley counties and generally outside the area affected by the Milk River Irrigation system. Threatened and endangered animals likely to occur in the five-county area are grizzly bear, Canada lynx, gray wolf, black-footed ferret, bald eagle, piping plover, Interior least tern, and whooping crane. The only plant species of concern is the slender moonwort, a candidate species found in Glacier County.

5.2.2 FEDERAL AND STATE STATUTES AND REGULATIONS

This section provides relevant information about the regulatory elements that exist in the absence of listing or CHD. Where proposed activities directly affect proposed critical habitat areas, these regulations may provide a level of protection to the species even in the absence of section 7 in the Act. The Federal statute that is applicable to this analysis is the CWA, discussed earlier in Section 3.2.2.3. There are no HCPs associated with the Saint Mary-Belly River population of bull trout. Neither the USFS nor the BLM have a presence in the Saint Mary or Belly River drainage, so Federal land management policies governing those agencies will not apply.

5.2.2.1 Montana Bull Trout Restoration Team

The Governor of Montana appointed a Bull Trout Restoration Team (MBTRT) in 1993. The team was charged with producing a plan that maintains, protects, and increases bull trout populations. A Montana Bull Trout Scientific Group was appointed by the MBTRT to provide technical expertise in assisting the MBTRT in its work. In 2000, the MBTRT produced a restoration plan that set forth strategies for increasing the maintenance, protection and increase in bull trout populations. This plan did not include an analysis of the Saint Mary-Belly River population. The State considered that since the watersheds involved were either in Glacier National Park, the Blackfeet Indian Reservation, or in Alberta, Canada, that they had no compelling interest in this population. They maintain no direct involvement in planning recovery activities but continue to monitor recovery work.

5.2.3 ELEMENTS OF THE RECOVERY PLAN

The Recovery Plan is currently available for public review. The Saint Mary-Belly River Management Unit consists of two primary core areas. The Belly River drainage and the North Fork Belly River in the

U.S. comprise one primary core area and the Saint Mary River in the U.S. the second primary core area. Included within the Saint Mary River primary core area are four secondary core areas.

In general, the report reviews the historical distribution, the distribution at time of listing, and current status of bull trout in the management unit. The reasons for bull trout decline are reviewed and discussed.

There are two dams in the management unit, Lake Sherburne between Glacier National Park and the Blackfeet Reservation and Saint Mary reservoir in Alberta, Canada. The existing impact to bull trout from Sherburne Dam stems primarily from the operation of the dam to supply irrigation water.

Forest management practices have not historically been a major factor affecting bull trout habitat as the area has not been a major producer of wood products. Past logging, with accompanying road construction, has left some localized problems. Grazing of domestic livestock historically has not been a major cause of the decline of bull trout.

Agricultural practices are influenced by the availability of irrigation water in this region. Beginning in 1902, the delivery of irrigation water has influenced stream flows and fish habitat in the recovery area. This has caused habitat problems through dewatering of streams and migratory disruption. Details of the irrigation supply system are discussed in Section 5.3, Effects on Agriculture and Grazing, which follows.

While several highways provide access to Glacier National Park, much of the recovery area remains roadless. Currently roads do not represent a major threat to bull trout in the management unit.

The basin was explored for minerals before Glacier National Park was created. Historically there was some mining in the U.S. portion of the basin, but currently there are no active mines.

Historically, the planting of non-native fish in Glacier National Park began before the park was created, significantly influencing the distribution of fishes in the basin. In some cases, non-native fish may have provided competition for parts of bull trout habitat.

Ongoing unit conservation activities are discussed next. Significant planning efforts have been going on for some time in the management unit and some recovery activities have been implemented. Among cooperating entities, the Blackfeet Nation adopted a new fishing regulation in 2000 prohibiting the taking or possession of bull trout. The tribe also, in cooperation with the Service, is developing a conservation easement program.

Both the Service and Glacier National Park have active programs benefiting recovery. The Service is developing partnerships and directing Federal funds to activities that benefit native fish. Glacier National Park is following NPS Guidelines governing the protection of natural ecosystems and displacement of native species by exotic species.

A strategy for recovery is developed. It begins with the establishment of the two primary core areas and the four secondary core areas. Next, goals and objectives for the recovery are set. The goal is to “ensure the long-term persistence of self-sustaining, complex interacting groups of bull trout distributed throughout the species' native range, so that the species can be delisted."

The objectives set to achieve this goal are:

- Maintain the current distribution of bull trout and restore distribution in previously occupied areas within the Saint Mary-Belly Management Unit.

- Maintain stable or increasing trends in bull trout abundance.

- Restore and maintain suitable habitat conditions for all life history stages and forms.

- Conserve genetic diversity and provide opportunity for genetic exchange.

A primary concern is the need for a more formal working relationship between U.S. and Canadian interests in addressing bull trout restoration in the Saint Mary and Belly River drainages. Because the local bull trout populations in the Saint Mary and Belly River drainages are comprised mostly of migratory fish, and much of their habitat is in Canada, coordination with these jurisdictions is absolutely critical to recovery.

Criteria are set that indicate the conditions under which it will be known that the goal and objectives have been met and the unit will be considered recovered. The criteria set forth conditions for distribution, abundance, population trends, and habitat connectivity needed for recovery. With respect to habitat connectivity, it is pointed out that substantial gains may be made by restoring unimpeded passage over Saint Mary Diversion Dam and eliminating entrainment in the Saint Mary Canal, which are the single most connectivity issue in the U.S. portion of the unit.

The report concludes with a monitoring strategy, actions needed, and an implementation schedule. The monitoring strategy consists of regular monitoring to acceptable standards in at least four of the identified populations to verify continued distribution and assess bull trout population status. The actions needed are described as a hierarchy of tasks going from general tasks to specific actions or programmatic activities that have been identified to meet the goal and objectives and the recovery strategy. The implementation schedule describes the priorities and schedule for accomplishing the action items. It also identifies responsible parties and provides cost estimates.

5.3 EFFECTS ON AGRICULTURE AND GRAZING

The purpose of this section will be to identify actions that are specific to the protection and improvement of bull trout populations. The subsequent economic analysis will center on the economic impacts of these actions.

The analysis will begin by identifying the economic activities most likely to be affected by bull trout conservation activities. This analysis will focus on the potential primary economic impacts to private parties and, to a lesser extent, the interagency section 7 consultation costs and any Federal expenditure.

This section provides an overview of the Saint Mary-Milk River Project and the issues currently associated with it. Next, a detailed description of the major features of the project is presented. This is followed by a discussion of the economic effects of the listing including section 7 consultations and project modifications. Finally the regional effects of providing instream flows to Swiftcurrent Creek are presented.

It should be noted that a water rights compact in the Milk River basin has been negotiated and is expected to be presented to Congress for approval in the near future. This compact may result in changes in both timing and quantity of water diverted from the Saint Mary River. As a consequence, the "with" and "without" cases will assume that the compact is in effect.

5.3.1 OVERVIEW OF THE USBR SAINT MARY-MILK RIVER PROJECT

The Milk River Basin in Montana and in the provinces of Alberta and Saskatchewan has historically been short of water to meet all needs. It has been reported that shortages for individual users relying on natural flows in the basin occur in two of ten years – due to insufficient water supply, not the inability to deliver water.[398]

Irrigation in the Milk River dates back to the 1880s. The Milk River Project is a major asset of the U.S., and constitutes the dominant use of Milk River water. It was conditionally approved by the Secretary of the Interior on March 14, 1903, to provide supplemental water for existing irrigated lands in the Chinook area, and to provide for a water supply and construction of a diversion and distribution facilities for irrigable lands in the Malta and Glasgow areas. Currently, there are more than 110,000 acres of lands served by the Milk River Project and a total of about 140,000 acres are irrigated in the basin. The USBR administers the project. Diversions from the Saint Mary River supply about half the Milk River Project's water in an average year and more than ninety percent in drought years.[399] The Saint Mary diversion provides a nexus with the Milk River Project even though they are geographically not contiguous.

Some of the key issues related to the shortage are:

1. The redistribution of available water supplies is an issue of growing importance in the Milk River Basin. In particular, the compact among the State of Montana, Federal government, and the Fort Belknap Indian Community includes a transfer of large amounts of water in the basin from historic

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[398] U.S. Department of the Interior, Bureau of Reclamation, Montana Area Office, March 2003, "North Central Montana – Alternatives Scoping Document," p.32.

[399] Ibid., p. 32.

users to the Fort Belknap Indian Community. Activities to provide mitigation for this transfer are part of the ongoing negotiations. Other tribes with interests in the Milk River basin are Blackfeet, Rocky Boy's, and Fort Peck Reservations.

2. The aging infrastructure of the Milk River Project (MRP), operated by the U.S. Bureau of Reclamation (USBR). Most project facilities were constructed between 1907 and 1937. The key component of the project is the Saint Mary Canal. The 29-mile long canal has outlived its design life, having been completed in 1915. The Saint Mary River Siphon in the canal and five large drop structures are in imminent danger of failure. Capacity has diminished from the design capacity of 850 cfs to about 650 cfs today due to siltation and deterioration. Canal headworks and diversion structures require modernization to avoid effects to the threatened bull trout. Rehabilitation of the Saint Mary Canal will be necessary if lands in the MRP are to remain in production.400

3. The likelihood that Canada will, in the future, use more of its allocation of Milk River water.

4. The presence and need for water to protect threatened and endangered species. The recovery plan for the Saint Mary-Belly River population of bull trout identifies a reach of Swiftcurrent Creek and the Saint Mary River between Lake Sherburne and the Saint Mary diversion canal as needing improved stream flow levels and characteristics.

5. Non-compliance of some water bodies with provisions of the CWA.

6. Settlement of reserved water rights for several Indian tribes.

5.3.1.1 The Milk River Project

Currently, there are more than 110,000 acres of lands served by the Milk River Project. Lands served directly by the Milk River include the eleven irrigation districts of the MRP, private irrigators with USBR contracts ("contract pumpers"), and private irrigators without USBR contracts ("independent"). Contract acres for the districts are 98,777 acres, and for the contract pumpers are 11,529 acres. Based on water right claims to the Montana Department of Natural Resource Conservation (DNRC) and DNRC's subsequent verification efforts, about 18,000 acres are irrigated outside of the MRP (see Table 110).

5.3.1.2 Saint Mary Diversion and Canal

The Saint Mary Storage Unit was authorized March 25, 1905. The Saint Mary Storage Unit consists of Lake Sherburne, Swift Current Dikes, Saint Mary Diversion Dam, and Saint Mary Canal. The Saint Mary Diversion Dam, located on the Saint Mary River, ¾-mile downstream from Saint Mary Lake, diverts water from the Saint Mary River to the Saint Mary Canal. The Saint Mary Canal terminates in the

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[400] Ibid., p. 33.

North Fork of the Milk River. This diversion system across the Hudson Bay divide into the Missouri River Basin provides supplemental water to the Milk River Project.

Table 110
State "Verified" Irrigation from the Milk River

Category of Use	Acreage
USBR Project	98,777
Contract Pumpers	11,529
Independent	18,293
Total Milk River	**128,599**

Source: Adapted from the Montana DNRC Water Right Claims GIS coverage and database for the Milk River, and U.S. Bureau of Reclamation records.

The Saint Mary Canal had an original capacity of 850 cfs along its 29-mile length. The continued reliance and use of Saint Mary Canal and Diversion is being addressed as a part of litigation and settlement for the Fort Belknap Indian Reservation water rights negotiations. In fact, the proposed compact specifies that a loss of the Saint Mary canal would nullify the settlement.

5.3.1.3 Fresno Reservoir

Fresno Reservoir is located on the Milk River 14 miles west of Havre. The USBR constructed Fresno Dam in 1939 under the National Industrial Recovery Act in order to provide more consistent water for users of the Milk River. The reservoir had an initial capacity of 129,062 acre-feet, but its actual capacity due to sedimentation declined to 103,397 acre-feet in 1978. Preliminary data from a sediment survey of Fresno Reservoir conducted during April 1999 indicates that the current capacity of Fresno Reservoir is 92,880 acre-feet. Water flowing into Fresno Reservoir is comprised of both the natural flow of the Milk River and water diverted from the Saint Mary River.

The International Boundary Waters Treaty of 1909 (proclaimed May 13, 1910), between the U.S. and Great Britain apportioned the water of the Milk and Saint Mary rivers and their tributaries between the U.S. and Canada. The waters are regulated and divided pursuant to a 1921 order of the International Joint Commission (IJC). During the irrigation season, Canada is entitled to one-fourth of the natural flow of the Milk River up to flow of 666 cfs, plus one-half of the flow above 666 cfs. During the non-irrigation season, the natural flow is divided equally. Canada does not utilize its full share of the Milk River on an annual basis, but occasionally uses more than its share during the irrigation season. If Canada develops its legal share of the Milk River, the frequency and severity of water shortages on the Milk River downstream of Fresno Reservoir will increase.

Water is released from Fresno Reservoir primarily for irrigation of lands in the Milk River Project. Water released from Fresno Reservoir also includes Fort Belknap Indian Reservation's stored water and natural flow *Winters* rights. Through a Memorandum of Agreement (MOA) between the BIA and USBR dated July 8, 1946 (I-1-IND-18725), BIA purchased a right to use one-seventh (1/7) of the Milk River natural flow stored in Fresno Reservoir for the Fort Belknap Indian Reservation. However, even with this additional water, the reservation is frequently short of water during the irrigation season.

5.3.2 PROJECT MODIFICATIONS FOR RECOVERY

Modifications in the Milk River Project are an important component of bull trout recovery in the Saint Mary-Belly management unit. The recovery plan states, "In the Saint Mary-Belly Recovery Unit substantial gains in reconnecting fragmented habitat within the Saint Mary River Core Area may be achieved by restoring unimpeded passage over Saint Mary Diversion Dam and eliminating entrainment in the Saint Mary Canal. The diversion and associated canal are the single most important connectivity issue in United States waters of this recovery unit…."

The Saint Mary diversion dam is more than 90 years old. Many of its component features, including the diversion facilities, are in a degraded state and in need of rehabilitation. Deterioration of the facilities and lack of modernization impacts the operation and efficiency of the facility. As such, the Bureau of Reclamation has investigated the rehabilitation of the entire dam and the more than 29 miles of canal associated with it.[401]

Project modifications are proposed for the Saint Mary diversion dam. Among the modifications are the means to enhance migration, to modify the entrance to the Saint Mary canal for fish passage, and to modify Sherburne Dam to provide instream flow in Swiftcurrent Creek. These modifications are presented as part of the alternatives for Saint Mary system rehabilitation.[402] Cost estimates for individual components of the proposed rehabilitation include $128,000 (in 2002 dollars) for bypass facilities at the Saint Mary Diversion dam, and $700,000 (in 2004 dollars) for Sherburne Dam modifications.[403] The total investment cost estimates for Saint Mary System rehabilitation range from $82 million for a canal with 500 cfs capacity to over $140 million for a canal with 1,000 cfs capacity.[404] Modifications for bull

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[401] U.S. Department of the Interior, Bureau of Reclamation, Montana Area Office, March 2003, "North Central Montana – Alternatives Scoping Document."

[402] Ibid., p. 69.

[403] At the time the draft version of this analysis was conducted, these estimates were not available. However, this revised analysis includes this new and relevant information based on comment received from the Bureau of Reclamation.

[404] U.S. Department of the Interior, Bureau of Reclamation, Montana Area Office, March 2003, "North Central Montana – Alternatives Scoping Document,". p. 70.

trout are a fraction of these costs. The implementation schedule contained in the recovery plan[405] provides a preliminary cost for fish passage around diversions at a total cost of $1,250,000. This covers three diversions; the United Irrigation District and Mountain View Irrigation District in Alberta, Canada, and the Saint Mary Diversion in Montana.[406] The Bureau of Reclamation estimates that the cost of fish screens to reduce entrainment on the Saint Mary Diversion would cost $4.27 million, in 2002 dollars, including design and installation.[407] In current dollars, the cost is approximately $4.37 million.

Based on a 20 year life for rehabilitation projects attributed to bull trout, the annual cost for a fish screen at the Saint Mary diversion is $412,200 (see Table 111).[408] Including the bypass facilities at the Saint Mary diversion and the Sherburne Dam modifications results in a total annualized cost of approximately $490,700 for project modifications. This results in a prospective cost of approximately $5,198,200.

Table 111
Project Modification Costs at Sherburne Dam and Saint Mary Diversion

Project Modification	Retrospective (Total)	Prospective (Total)		Prospective (Annualized)
		3%	7%	
Sherburne Dam Modifications	$0	$1,321,500	$700,000	$66,100
Saint Mary Diversion Bypass Facilities	$0	$247,200	$130,900	$12,400
Saint Mary Diversion Fish Screens	$0	$6,133,100	$4,367,300	$412,200
Total	**$0**	**$7,701,800**	**$5,198,200**	**$490,700**

The Saint Mary Rehabilitation Working Group is conducting the gathering of support to seek financing to rehabilitate the Saint Mary System, including the restoration activities to protect bull trout. Members of this group represent agriculture, business, tribes, government agencies, towns, and anglers.[409] The group has submitted a request for funding, in the form of legislation, to the Montana's Congressional

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405 U.S. Fish and Wildlife Service, 2002, "Chapter 25, Saint Mary-Belly River Recovery Unit, Montana," in *Bull Trout (Salvelinus confluentus) Draft Recovery Plan*, p. 111.

406 Ibid., p. 94.

407 The draft version of this analysis did not have project-specific information, and applied an estimated average cost of approximately $420,000 per modification. The Bureau of Reclamation provided project-specific estimates in a comment and this information has been incorporated into this analysis.

408 Consistent with the time frame used throughout this analysis, costs associated with the first 20 year period are estimate and discounted using a three and seven percent rate (see Section 2.4).

409 Ogden, Karen, February 19, 2004, "Montanans pushing hard to get legislation into pipeline to refurbish St. Mary's Canal," *Great Falls Tribune*.

Delegation.[410] The delegation has received the request[411] and Senator Conrad Burns, chairman of the Interior Subcommittee of the Senate Appropriations Committee, will review funding options for the rehabilitation.[412]

Locally, Montana Governor Judy Martz approved a $100,000 grant from the State's Environmental Contingency Account and local entities are working to raise a matching amount and the Milk River Joint Board of Control (composed of Milk River Project irrigation districts) voted to raise half the amount.[413] Later it was announced that the Milk River Joint Board of Control has pledged $50,000 and the Montana Chapter of Walleye's Unlimited (a fishing organization) pledged $5,000. The funds will be used for engineering studies.[414]

Because of the aggregated nature of the cost estimates, it is not possible to separate out costs that could be attributed to bull trout recovery from those costs of overall rehabilitation plans and compact settlement considerations. Since this is a Federal project, a substantial part of the costs will likely be borne by the Federal government and consequently all taxpayers. There is significant evidence that State and local interests have a willingness to provide financial support also.

A list of caveats and assumptions used in this analysis are presented in Table 112.

Table 112
Caveats and Uncertainties

Assumption	Direction of Bias
Analysis assumes availability of Federal, state, or other financing for the project	+
Analysis assumes the project would have occurred "but for" the bull trout listing and that it's not considered part of overall rehabilitation plans and/or compact settlement considerations	+
Analysis assume future engineering studies will confirm the feasibility of the project	+
Analysis is based on preliminary estimates for fish passage costs	+/-

+: This assumption is likely to produce an upward bias in cost estimates.

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410 Ibid.

411 Ogden, Karen, March 7, 2004, "Delegates plan push for canal rehabilitation: More than half of $9.5 million request is for emergencies," *Great Falls Tribune*.

412 Ibid.

413 Ogden, Karen, March 19, 2004, "Canal study will focus on benefits," *Great Falls Tribune*.

414 Miller, Jared, April 29, 2004, "Fund drive raises $55,000 for repairs to St. Mary Canal," *Great Falls Tribune*.

-: This assumption is likely to produce a downward bias in cost estimates.

+/-: No direction of bias can be determined.

5.3.3 Economic Effects on Agriculture from Reduced Water Supply

There is a potential for an economic effect on the Milk River Project from an allocation of water for instream flow in Swiftcurrent Creek. During the irrigation season, there are high instream flows in Swiftcurrent Creek as water is released from Sherburne Reservoir. The released water flows down Swiftcurrent Creek into the Saint Mary River, and is diverted into the Saint Mary Canal for delivery to the Milk River Project. At the end of the irrigation season, releases from Sherburne Reservoir cease, and Swiftcurrent Creek is de-watered. Pools of water remain, but fish passage between pools is not possible. On occasion, bull trout have become trapped in these pools at the end of the irrigation season and were frozen in ice and perished. The remedy to this situation is to provide instream flows during the non-irrigation season. Suitable flow levels have not been determined, but might be equivalent to winter inflow rates into Sherburne Reservoir, on the order of 20 to 30 cfs.[415]

Twenty cfs for six months requires about 7,200 acre-feet of stored water and 30 cfs for six months about 10,800 acre-feet. [416] Since the diversion to the Saint Mary Canal would be closed during the time of these flows, the water released would flow down the Saint Mary River into Canada and would be lost to the Milk River Project.

The loss to the Milk River Project would not be the full amount of the water released as there are losses during transmission as the water flows through the Saint Mary Canal, through the Milk River across Canada, and then into Fresno Reservoir and finally into the Milk River Project canals. It is estimated that the loss from the time it is released from Sherburne Reservoir and arrives at Fresno Reservoir is about 10 percent, with an additional 20 percent lost between Fresno Reservoir and Milk River Project canals.[417]

At the low estimate of 7,200 acre-feet of water not available for release for irrigation, the Milk River Project canals would receive about 5,000 acre-feet less and at the high estimate of 10,800 acre-feet, 7,600 acre-feet less.

Social welfare losses are the losses in consumer and producer surpluses associated with the change in prices resulting from shifts in demand and supply functions for goods and services.[418] For the social

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415 Personal communication with Service Biologist, Montana Fish and Wildlife Management Assistance Office, Bozeman, Montana, June 9, 2004.

416 Montana Water Resources Board, "Handy Water Equivalents," Helena, Montana.

417 Personal communication with Scott Guenthner, Hydrologist, USBR, Billings, Montana, June 10, 2004.

418 U.S. Environmental Protection Agency, September 2000, *Guidelines for Preparing Economic Analyses*, EPA 240-R-00-003, http://yosemite.epa.gov/ee/epa/eed.nsf/webpages/Guidelines.html.

welfare loss effect of the conservation activities for the Saint Mary-Belly River population of bull trout on the Milk River Project, the question is how would output levels or production costs change for the commodities produced in the project?

The two major outputs from the project area are wheat and cattle and calves. Most of the wheat is dryland (produced without irrigation), but an estimated 42,000 acres of wheat and barley are irrigated in the project area. Production of cattle and calves combines the output from irrigated alfalfa and other hay (about 87,000 acres) with the output of pasture and private and public grazing lands. Assuming reduced water supply is applied to the crops on a proportional basis, gross revenues to producers in the Milk River Project would be reduced $360,000 per year for a 5,000 acre-foot reduction in water supply. If the water supply is reduced by 7,600 acre-feet, gross revenues would decline by $547,000 per year. The change in *net* revenue, or the amount of income lost by producers, is approximately ten percent of the gross revenues. Hence, an amount of $36,000 to $54,700 per year represents the direct cost attributable to agriculture associated with the reduction in water supply (see Table 113).

Total wheat production from the project area counties is 1.5 percent of national wheat production and only a small fraction of area production is irrigated. It is unlikely that changes in irrigated wheat production would affect national wheat prices and social welfare. The same situation exists for the production of cattle and calves in the area, which represents one quarter of one percent of the national production of cattle and calves, also unlikely to affect social welfare. Table 114 summarizes the assumptions made in these calculations.

Table 113
Economic Effects on Agriculture from a Reduced Water Supply

Category	Retrospective (Total)	Prospective (Total)		Prospective (Annualized)
		3%	7%	
Change in Producer Profit	$0	$534,920 - $813,084	$380,908 - $578,984	$35,955 - $54,652

Table 114
Caveats and Uncertainties

Assumption	Direction of Bias
Analysis assumes the amount, timing, and means for delivery instream flow will result in impact to bull trout. To date, the Service and USBR have not determined the volume or timing of instream flow needs	+
Analysis assumes that instream flows are "lost to irrigators." Its possible, however, that waters may be stored downstream in Canada and may be swapped or otherwise used as part of a reconfigured allocation agreement.	+
Analysis excludes consideration of instream flow benefits to the Saint Mary River fishery located downstream of Swiftcurrent Creek. In fact, benefits are likely to extend to this fishery, as well as the fisheries located downstream in Canada.	-

+: This assumption is likely to produce an upward bias in cost estimates.

-: This assumption is likely to produce a downward bias in cost estimates.

+/-: No direction of bias can be determined.

5.3.4 Regional Economic Impacts of Milk River Project Water Supply Reductions

Regional economic impact analysis can be used to determine the potential distributional effects of conservation activities, as discussed in Section 1.1.2. By using an input-output (I-O) model for the local economy, it is possible to quantify the additional changes in the regional economy that result from an initial change, such as reduced water supply for agricultural irrigation. A full discussion of the application of regional economic analysis is presented above in Section 1.1.2.2. It is important to note that regional economic impacts are distributional effects, which are fundamentally different measures of economic costs than efficiency effects, and cannot be added to or compared with the other economic cost estimates (efficiency effects) presented in this report.

In previous work, NEA developed an agricultural production model and a regional I-O model to measure the effects of changes in water supplies in the Milk River Project.[419] The regional project area includes the five county area encompassing the Milk River Project and the Saint Mary Diversion Dam: Glacier, Blaine, Hill, Phillips, and Valley counties. NEA updated this work to develop response coefficients that showed the amount of value added from an acre-foot of water.[420] To analyze the effects of providing instream flow in Swiftcurrent Creek on the Milk River Project area, the concept of a response coefficient developed in the working paper were expanded to include labor income (the sum of employment compensation and proprietary income) and jobs per acre-foot. One thousand acre-feet of water delivered to Milk River Project canals supported $14,300 dollars of labor income and 1.1 jobs. A reduction of 5,000 acre-feet suggests that about $71,500 dollars less labor income and six fewer jobs would be supported in the Milk River Project area. At the 7,600 acre-feet level, this would be about $110,000 less labor income and eight less jobs.

5.4 Effects on Mining Operations

There are no effects from mining in the U.S. portion of the unit. There have been no mining related consultations.[421]

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[419] Northwest Economic Associates, February 10, 2000, *Measuring the Economic Impacts of Settlement Options Associated with Water Rights of the Fort Belknap Indian Reservation*, Draft Report.

[420] Northwest Economic Associates, 2004, *Milk River Project Irrigation Response Coefficients*, draft working paper.

[421] Personal communication with Service Biologist, Montana Ecological Services, Helena Field Office, Helena, Montana, June 8, 2004.

5.5 EFFECTS ON RECREATIONAL VISITATION

Prior to the listing of bull trout, recreational anglers in Glacier National Park were permitted to catch and keep one bull trout per day. Following the listing of bull trout, the park changed its policy to no longer allow targeting of bull trout, and to require immediate release of an incidental catch.[422] Since bull trout is not a highly sought game fish in the park, it is not anticipated that such regulations have had any effect on recreation activity retrospectively, or will reduce recreation activity in the future. In addition, there have been no recreation related consultations between Glacier National Park and the Service.[423]

5.6 EFFECTS ON ROAD MAINTENANCE AND TRANSPORTATION

There has been one ongoing informal consultation with the U.S. Department of Transportation on U.S. Highway 89. This consultation has occurred over a period of years and is currently not active pending revisions in transportation plans.[424]

5.7 ADMINISTRATIVE COSTS OF CONSULTATION

Informal consultations related to bull trout and the Milk River Project between the Service and USBR have been ongoing since 1998.[425] These consultations take place in the complex social, economic, and political situation described above that includes adjudication of State water rights, serious deterioration of Milk River Project infrastructure, and the consideration of mitigation activities in the Fort Belknap compact negotiations. There are many stakeholders in this complex situation; those who depend on a continuing water supply for their health and for their livelihood, those that seek protection for the environment, and those in the State and nation that will support the work financially.

A principal component of the informal consultation is USBR financial support for ongoing research by the Service on bull trout habitat and behavior. This collaboration began in 1998 and is continuing. During this time, activities other than the research have been part of the informal consultation (see Table 115). An electronic barrier in the canal intake was purchased and installed and is being monitored for its

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422 Personal communication with Bill Michels, Biologist, National Park Service, Glacier National Park, June 24, 2004.

423 Personal communication with Service Biologist, Montana Ecological Services, Helena Field Office, Helena, Montana, June 8, 2004.

424 Personal communication with Service Biologist, Montana Ecological Services, Helena Field Office, Helena, Montana, June 8, 2004.

425 Personal communication with Sue Camp, Natural Resource Specialist, USBR, Montana Area Office, June 2, 2004.

effectiveness. In 2003 and 2004, fish salvage operations took place in Swiftcurrent Creek to rescue fish stranded due to de-watering. Some design work on structure modification was also undertaken.[426]

Table 115
Expenditures in Support of Informal Consultations, USBR

Category	1998	1999	2000	2001	2002	2004	2004
Total Expenditures	$70,000	$70,000	$70,000	$157,000	$203,000	$267,000	$261,000

Source: Personal communication with Sue Camp, Natural Resource Specialist, USBR, Montana Area Office, June 2, 2004.

Informal consultations are expected to continue for some time, perhaps 15 years or longer. Expenditures are expected to continue near current levels of $250,000 to $275,000. The prospective cost applying a seven percent discount rate is $2.8 million.

5.8 SUMMARY OF EFFECTS ON THE BELLY RIVER

The preceding discussions of economic effects associated with Saint Mary-Belly River population apply largely to the Saint Mary River watershed. The Belly River watershed and the proposed critical habitat of approximately 1.5 miles is contained wholly within a backcountry portion of Glacier National Park. No economic effects associated with conservation activities for the bull trout attributable to the Belly River proposed critical habitat are identified.

5.9 POTENTIAL EFFECTS ON TRIBAL ACTIVITIES

As discussed in Section 5.1.4, approximately 41.9 of proposed CHD is within the exterior boundary of the Blackfeet Indian Reservation. Secretarial Order 3206 articulates that tribal governments have the authority to protect and manage their resources in a manner that is most beneficial to their tribe.[427] As trustee for land held in trust by the United States on behalf of tribes, the BIA provides technical assistance and planning, and oversees a variety of programs on tribal lands. This section provides a discussion of the potential effects on tribal activities on their reservations. The administrative costs associated with section 7 consultation for activities occurring on tribal lands are included above in Section 5.7.

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426 Ibid.

427 A comment received from the Blackfeet Tribe suggested that the draft version of this analysis was inadequate in terms of the analysis of impacts to the Tribe, particularly through an erroneous interpretation of Secretarial Order 3206; that is, the Order gives deference to tribal conservation and management plans, but provides no assurance that tribal development will not be impacted. This analysis estimates economic impacts of bull trout conservation efforts on all lands within the proposed CHD, including on tribal lands. The analysis also notes the Blackfeet Nation's role as a cooperating entity, including in the development of a conservation easement program. In determining the impacts on tribal entities, this analysis assesses the reasonably foreseeable burdens of CHD. It does not presume that the existence of such plans assures there would be no impacts.

5.9.1 BLACKFEET INDIAN RESERVATION

The Service and Blackfeet Tribal Council representatives have held a number of government-to-government meetings discuss bull trout critical habitat and associated recovery issues. Following the proposed determination of critical habitat by the Service on June 25, 2004, the attorney for the Tribe submitted a letter of comments on the designation, including a statement of the Tribe's opposition to CHD on tribal lands.[428] The Tribe is concerned, among other things, about the extent of economic impacts to the Tribe and its people. Specifically, the Tribe seeks determination of the economic impacts on: (1) trust resources, (2) development within the boundaries of the Reservation, (3) the ability of the Tribe to use its presently unused water rights, and (4) tribal funds as a result of mitigation measures implemented by the Service.[429]

The BIA has a responsibility for the protection of trust resources of the Tribe. As such, activities or actions that may have the potential for resulting in an effect on listed species will require section 7 consultations between the BIA and the Service. The Tribe, as co-manager of trust resources, may participate in the consultations; as such, the tribal government may incur additional costs associated with its participation. In the past, the Tribe has devoted staff time to resource and bull trout recovery teams, and to the development of ordinances and water quality protections. More recent involvement by the Tribe in recovery team activities has been limited. The Tribe has indicated in a comment on the DEA that it intends to be involved in recovery efforts in the future. If the future involvement is similar to the level of past effort, costs associated with bull trout conservation efforts would amount to approximately $20,000 per year.

To date, there have been no past consultations for bull trout within the Reservation boundaries. In addition, there is no indication that restrictions on development of the Tribe's timber or mineral resources are reasonably foreseeable.

The Tribe has expressed concern that, because the United States holds most of the land and water resources on the Reservation in trust, development requires a Federal action and a section 7 consultation will ensue. However, Secretarial Order 3206 directs the Service to "harmonize the Federal trust responsibility to tribes' tribal sovereignty" when implementing the Act. Based upon past history of the joint management of the BIA and the Tribe of tribal resources, it is not reasonably anticipated that additional burdens associated with conservation of the listed species would be required.

The Tribe lays claim to "all water arising on, flowing through, bordering or underlying the Reservation."[430] These water rights are the subject of ongoing negotiations between the Tribe, the state

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[428] Whiteing, Jeanne S., Attorney for the Blackfeet Tribe of the Blackfeet Indian Reservation, August 24, 2004, Letter to the Bull Trout Coordinator, U.S. Fish and Wildlife Service, p. 1.

[429] Ibid., pp. 6-8.

[430] Ibid., p. 1.

of Montana, and the Federal government. Furthermore, the United States filed protectiveFederal reserved water right claims with the state of Montana in 1982 for a considerable amount of water in the Saint Mary River drainage with early (pre-1900) priority dates. In 1997, the United States filed a "More Definitive Statement of Claim" with the Montana Water Court.[431] This includes 50,842 acre-feet for irrigation purposes; 56,542 acre-feet for municipal, industrial, commercial, domestic, and stock watering purposes; and 83,024 acre-feet for lake level maintenance.[432]

The Federal reserved water rights of the Tribe that will be ultimately decreed, either through negotiation or litigation, are unknown and yet to be determined. This includes the entire quantity, sources, timing, and purposes of use for the Blackfeet Tribe's Federal reserved water rights. Many highly variable factors will affect the water rights determination, including the respective negotiating positions of the three parties involved, the proposed water rights compact involving the Tribes of the Fort Belknap Indian Reservation which uses Saint Mary River water, reconciliation of water rights among the affected entities, and the rehabilitation status of the Saint Mary Diversion.

The United States is preparing to defend the filed water right claim on behalf of the Tribe in court or negotiation; however, the water right that is ultimately decreed is uncertain. Nevertheless, research on this issue provided no indication that the Tribe will be hindered in its development or use of its water rights, particularly in light of Secretarial Order 3206, which authorizes a Tribe to manage its resources that is most beneficial to them.

5.9.2 Fort Belknap Indian Reservation

The Fort Belknap Indian Reservation lies adjacent to the Milk River in Blaine and Phillips counties. Although not located in the proposed CHD, the reservation is within the economic region that could be potentially affected by the CHD. This impact would occur only if water supply for tribal irrigators is reduced. However, irrigated lands on the reservation have the senior water right in the Milk River, and no reduction in water supply to the reservation is anticipated.

5.10 Potential Effects on Small Entities and Energy Supply

The potential effects on small entities and energy supply resulting from the proposed CHD rulemaking for the Saint Mary-Belly River population of bull trout are discussed in Appendix A to this report.

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[431] A comment received on the draft version of this analysis clarified that the original protective water right claims filed by the United States were superceded by the "More Definitive Statement of Claim" that can be interpreted as the United States' position on the water rights of the Tribe.

[432] Whiteing, Jeanne S., Attorney for the Blackfeet Tribe of the Blackfeet Indian Reservation, August 24, 2004, Letter to the Bull Trout Coordinator, U.S. Fish and Wildlife Service, p. 1.

5.11 SUMMARY AND ANALYSIS OF EFFECTS IN THE SAINT MARY–BELLY RIVER REGION

Table 116 provides a summary of the economic impacts due to bull trout conservation activities for each of the activities analyzed in this analysis. Retrospective costs total $1,098,000, associated primarily with section 7 consultation efforts between the Service and the USBR regarding the Saint Mary-Milk River Project. Total prospective costs are approximately $8.8 million applying a seven percent discount rate. Annualized prospective costs are estimated to be $827,800. Costs associated with reduced water supply to the Milk River Project, project modifications at the Saint Mary diversion and Sherburne Dam, and future consultation costs account for the prospective costs.

Table 116
Summary of Economic Impacts Associated with Bull Trout Conservation Activities in the Saint Mary-Belly River Proposed Critical Habitat

Category of Impact	Retrospective (Total)	Prospective (Total)		Prospective (Annualized)
		3%	7%	
Agriculture	$0	$813,084	$578,984	$54,652
Project Modifications	$0	$7,701,800	$5,198,200	$490,700
Mining	$0	$0	$0	$0
Recreation	$0	$0	$0	$0
State and Federal Agencies	$1,098,000	$3,905,337	$2,780,929	$262,500
Blackfeet Tribe	$0	$297,500	$211,900	$20,000
Total	**$1,098,000**	**$12,717,700**	**$8,770,000**	**$827,800**

5 U.S.C. § 601 *et seq*.

16 U.S.C. § 1532.

16 U.S.C. § 1533(b)(2).

16 U.S.C. § 1533.

33 U.S.C. §1251 (1987).

33 U.S.C. §303, 305.

33 U.S.C. §402.

33 USC 1344.

Alliance for the Wild Rockies, Inc., Friends of the Wild Swan, Inc., v. Badgley et al., CV 01-127-JO (D. Ore.).

Andersen, James R., Northwest Indian Fish Commission, Executive Director, August 24, 2004, Letter to Bull Trout Coordinator, U.S. Fish and Wildlife Service.

Anderson, Roy C., and Eric N. Hansen, 2002, "Do Forest Certification Ecolabels Impact Consumer Behavior? Results from an Experiment," Oregon State University, Wood Science and Engineering.

Baker, L. R., March 2003, "Digital Inventory of Flood-Plain Mines in Washington State," Washington Department of Natural Resources, Division of Geology and Earth Resources.

Berg, Ken S., and Steven W. Landino, December 23, 2004, Joint Letter from U.S. Fish and Wildlife Service and NOAA Fisheries to Ed O'Brien, Washington Department of Ecology.

Blackfeet Nation, January 20, 2005, http://www.blackfeetnation.com.

Blattel-Sam, Lori, and Jim Harvey, March 31 2003, "Biological Assessment for Bull Trout on the ongoing activities in the Jarbidge River Watershed," USFS, Humboldt-Toiyabe National Forest.

Bolon, W.P., 2003, "Construction Sand and Gravel," United States Geological Survey.

Bonneville Power Administration, Fish and Wildlife Group, "Implement Willamette Basin Mitigation Project." BPA Project Number 199206800, http://www.cbfwa.org/files/awp00/projects/9206800.htm#5, accessed February 4, 2005.

Bonneville Power Administration, May 19, 2004, Pacific Northwest Hydrosite Database (NWHS).

Bonneville Power Administration, n.d., Pacific Northwest Hydrosite Database NWHS.

Capazza, D.R., and R.W. Helsley, 1990, "The Stochastic City," *Journal of Urban Economics*, Vol. 28, pp. 187-203.

Casitas Municipal Water District, December 9, 2004, "Casitas Celebrates Grand Opening of Steelhead Fish Ladder on the Ventura River," http://www.casitaswater.org/fish%20passage%20facility/casitas%20celebrate%20grand%20opening%20of%20steelhead%20fish%20ladder.htm, accessed February 4, 2005.

Cassidy, K. M., January 1997, "Land Cover of Washington State: Description and Management," Washington Cooperative Fish and Wildlife Research Unit, University of Washington.

Chelan County Public Utility District, 1998, *Rocky Reach Hydroelectric Project, Anadromous Fish Agreement and Habitat Conservation Plan*.

Daniels, Mitchel E., July 13, 2001, "Memorandum for Heads of Executive Departments and Agencies, and Independent Regulatory Agencies," M-01-27, http://www.whitehouse.gov/omb/memoranda/m01-27.html.

Douglas County Public Utility District, July 31, 1998, *Wells Hydroelectric Project, Anadromous Fish Agreement and Habitat Conservation Plan*.

Dun and Bradstreet, January 2004, accessed through a Dialog search of File 516, Dun and Bradstreet, "Dun's Market Identifiers."

Elwha Project Human Effects Team, February 1995, *Elwha River Restoration Project: Economic Analysis*, Final Technical Report.

Engrossed Substitute House Bill 2496; and RCW 77.85.005. http://www.leg.wa.gov/RCW/index.cfm?section=77.85.005&fuseaction=section.

Ereth, Marty, Skokomish Natural Resources, Habitat Biologist, August 24, 2004, "Comments Supporting an Exclusion of Skokomish Tribal Lands from a Critical Habitat Designation."

Evergreen Funding Consultants, Spring 2003, "A Primer on Habitat Project Costs, Puget Sound Shared Strategy for Salmon Recovery."

Executive Order 12866, September 30, 1993, "Regulatory Planning and Review."

Executive Order 13211, May 18, 2001, "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use."

Federal Energy Regulatory Commission, August 1998, Project No. 460-001 and –009, Order Issuing Subsequent Major License, Dismissing Complaint as Moot, and Rejecting Motion to Intervene, (Document ID 1872175).

Federal Energy Regulatory Commission, August 3, 2003, "Exemptions from Licensing," http://www.ferc.gov/industries/hydropower/gen-info/exemptions.asp, accessed June 23, 2004.

Federal Energy Regulatory Commission, March 31, 1999, Project No. 460-011 and –014, Order on Rehearing.

Federal Energy Regulatory Commission, Office of Hydropower Licensing, November 1996, *Final Environmental Impact Statement, Cushman Hydroelectric Project (FERC Project No. 460), Washington*.

Federal Power Act, 16 USC 791-828c.

Federal Water Pollution Control Act of 1972, Section 402 (Clean Water Act), paragraph (p). P.L. 100-4.

The Foundation for Water and Energy Education, 2002, Northwest Hydro, "About Hydropower: America's Largest Renewable Resource," http://www.fwee.org/abhydro.html, accessed September 10, 2004.

Foster, Alix, Swinomish Tribal Community, Director, Office of Tribal Attorney, May 18, 2004, Letter to Chief, Listing and Candidate Conservation, U.S. Fish and Wildlife Service.

Geoghegan, J., 2002, "The Value of Open Spaces in Residential Land Use," *Land Use Policy,* Vol. 19, pp. 91-98.

Global Precision Medical, Inc., September 25, 2002, "San Antonios Resources Inc. announces Company Reorganization, Name Change and Acquisition of Medical Device Technology," http://www.globalprecisionmedical.com/s/PressReleases.asp?ReportID=42918&_Title=San-Antonios-Resources-Inc.-announces-Company-Reorganization-Name-change-an.

GORP, "Mt. Rainier National Park: Fishing and Boating," http://gorp.away.com/gorp/resource/us_national_park/wa/fis_mrnp.htm, accessed June 10, 2004.

GORP, "North Cascades National Park," http://gorp.away.com/gorp/resource/us_national_park/sum_pick7.htm, accessed June 2, 2004.

GORP, "North Cascades National Park: Fishing," http://gorp.away.com/gorp/resource/us_national_park/wa/fish_nor.htm, accessed June 2, 2004.

GORP, "Olympic National Park: Fishing," http://gorp.away.com/gorp/resource/us_national_park/wa/fish_oly.htm, accessed June 2, 2004.

Gramlich, Edward M., 1990, *A Guide to Benefit-Cost Analysis (2nd Ed.)*, Prospect Heights, Illinois: Waveland Press, Inc.

Guerrero, Edward, BLM, Jarbidge Field Manager, April 13, 2001, Letter to Chuck Jones, Buck Creek Ranch, Inc.

Huppert, Daniel D., Davil L. Fluharty, Eric E. Doyle, and Amjoun Benyounes, October 1996, *Economics of Snake River Salmon Recovery: A Report to National Marine Fisheries Service*, University of Washington School of Marine Affairs.

Interior Columbia Basin Ecosystem Management Project (ICBEMP), GIS Coverage for Land Ownership, http://www.icbemp.gov/html/spatial.shtml.

Irwin, E.G., and N.E. Bockstael, 2002, "Interacting Agents, Spatial Externalities, and the Endogenous Evolution of Residential Land Use Pattern," *Journal of Economic Geography*, Vol. 2, No. 1, pp. 31-54.

King County Wastewater Treatment Division, August 11, 2004, "Habitat Conservation Plan," http://dnr.metrokc.gov/wtd/hcp/.

King County Wastewater Treatment Division, February 8, 2005, "Brightwater Treatment Plant," http://dnr.metrokc.gov/wtd/brightwater/.

King County Wastewater Treatment Division, January 26, 2005, “Facts at a Glance,” http://dnr.metrokc.gov/wtd/wtdfacts.htm.

King County Wastewater Treatment Division, May 30, 2003, “Frequently Asked Questions about the HCP,” http://dnr.metrokc.gov/wtd/hcp/faq.htm.

King County, August 26, 2003, “Shoreline Master Program Update: Shoreline Management in Washington State: A Legislative and Regulatory History as It Relates to King County,” http://www.metrokc.gov/ddes/SMP/SMAHistory.shtm, accessed May 24, 2004.

Klott, J., and T. Burton, February 27, 2003, “Biological Assessment for Bull Trout on the Ongoing Activities in the Jarbidge River Watershed,” Bureau of Land Management, Jarbidge Field Office.

Langer, W.H., 2002, “A General Overview of the Technology of In-Stream Mining of Sand and Gravel Resources, Associated Potential Environmental Impacts, and Methods to Control Potential Impacts,” Open-File Report OF-02-153, U.S. Geological Survey.

Lansford, N.H., and L.L. Jones, July 1995, “Marginal Price of Lake Recreation and Aesthetics: An Hedonic Approach,” *Journal of Agricultural and Applied Economics,* Vol. 27, No. 1, pp. 212-223.

Leggett, Christopher, and Nancy E. Bockstael, March 2000, “Evidence of the Effects of Water Quality on Residential Land Prices,” *Journal of Environmental Economics and Management*, Vol. 39, No. 2, pp. 121-144.

Mahan, Brent L., Steven Polasky, and Richard M. Adams, February 2000, “Valuing Urban Wetlands: A Property Price Approach,” *Land Economics*, Vol. 76, No. 1, pp. 100-113.

Miller, Jared, April 29, 2004, “Fund drive raises $55,000 for repairs to St. Mary Canal,” *Great Falls Tribune.*

Montana Water Resources Board, “Handy Water Equivalents,” Helena, Montana.

Montgomery Water Group, February 7, 2005, Exhibit 2-6, Sequim-Dungeness Valley Agricultural Water Users Overview of Canals, for Comprehensive Irrigation District Management Plan.

Montgomery Water Group, October 1999, “Dungeness River Agricultural Water Users Association Comprehensive Water Conservation Plan,” prepared for Washington Department of Ecology.

Mooney, 1997, "A Cost Effectiveness Analysis of Actions to Reduce Stream Temperature: A Case Study of the Mohawk Watershed," Ph.D. Dissertation, Department of Agricultural and Resource Economics, Oregon State University.

Municipal Research and Services Center of Washington, February 2004, "Comprehensive Planning/ Growth Management," http://www.mrsc.org/subjects/planning/compplan.aspx, accessed May 20, 2004.

National Hydropower Association, "Hydro Facts: Hydropower: A Popular Electricity Option," http://www.hydro.org/hydrofacts/popular_choice.asp, accessed February 14, 2005.

National Park Service, "North Cascades National Park: Activities," http://www.nps.gov/noca/pphtml/ activities.html, accessed June 2, 2004.

National Park Service, "Olympic National Park: Fish and Shellfish Regulations," http://www.nps.gov/ olym/regs/fishregs.htm, accessed June 9, 2004.

National Park Service, August 6, 2001, "Director's Order – 82, Public Use Data Collecting and Reporting Program."

National Park Service, October 28, 1998 (last updated), "North Cascades National Park: Fishing Regulations," http://www.nps.gov/noca/fishing-regs.htm, accessed May 28, 2004.

National Park Service, Public Use Statistics Office, "NPS Visitation Database Reports, Park by Year 1904-2003," http://www2.nature.nps.gov/stats/, accessed August 31, 2004.

National Visitor Use Monitoring (NVUM), 2001, USDA Forest Service, Region 6, Olympic National Forest, http://www.fs.fed.us/recreation/programs/nvum/reports/year1/R6_Olympic_final.htm, accessed June 1, 2004.

Nevada Department of Transportation, "Elko 2002 Traffic Counts," http://www.nevadadot.com/ reports_pubs/traffic_report/2002/.

Nevada Department of Wildlife, "Hunting," http://www.ndow.org/hunt/, accessed June 5, 2004.

Nevada Department of Wildlife, "Fishing: Angler Information Guides - Eastern Nevada," http://www. ndow.org/fish/waters/east.shtm, accessed June 16, 2004.

Nevada Department of Wildlife, "Fishing License Sale Statistics by County." http://www.ndow.org/about/license/sales/, accessed on September 9, 2004.

Nevada Fish and Wildlife Office, November 17, 2004, *Biological Opinion on the Bureau of Land Management's Ongoing Activities in the Jarbidge River Watershed in Owyhee County, Idaho and Elko County, Nevada*, File No. 1-5-03-F-114.

New Mexico Cattle Growers Association vs. U.S. Fish and Wildlife Service, 248 F.3d 1277 (10th Cir. 2001).

NOAA Fisheries Puget Sound Technical Recovery Team, November 2004, *Initial Assessment of NOAA Fisheries' Critical Habitat Analytical Review Teams for 13 Evolutionarily Significant Units of Pacific Salmon and O. mykiss*.

Norman, D. K., C. J. Cederholm, and W. S. Lingley, September 1998, "Flood Plains, Salmon Habitat, and Sand and Gravel Mining," *Washington Geology*, Vol. 26, No. 2/3.

Northwest Economic Associates, 2004, "Milk River Project Irrigation Response Coefficients," Draft working paper.

Northwest Economic Associates, February 10, 2000, "Measuring the Economic Impacts of Settlement Options Associated with Water Rights of the Fort Belknap Indian Reservation," Draft Report.

Northwest Indian Fisheries Commission, "Overview," http://www.nwifc.wa.gov/aboutus/overview.asp.

Ogden, Karen, February 19, 2004, "Montanans pushing hard to get legislation into pipeline to refurbish St. Mary's Canal," *Great Falls Tribune*.

Ogden, Karen, March 19, 2004, "Canal study will focus on benefits," *Great Falls Tribune*.

Ogden, Karen, March 7, 2004, "Delegates plan push for canal rehabilitation: More than half of $9.5 million request is for emergencies," *Great Falls Tribune*.

Perez-Garcia, Jane Edelson, and Kevin Zobrist, January 22, 2001, *Small Business Economic Impact Statement for New Proposed Forest Practices Rules Implementing the Forests and Fish Report*, DNR Agreement #FY00-133.

Pub. Law No. 104-121.

Puget Sound Energy; September 27, 1999, "White River Q&A," http://www.savelaketapps.com/puget_sound_energy.htm, accessed April 28, 2004.

R2 Resource Consultants, Inc., November 2003, "Storedahl Daybreak Mine HCP."

Revised Code of Washington (RCW) 36.70A.172, "Critical Areas – Designation and Protection – Best Available Science to Be Used."

Revised Code of Washington (RCW) 77.85.050.

Revised Code of Washington (RCW) 90.58.020.

Riddel, M., 2001, "A Dynamic Approach to Estimating Hedonic Prices for Environmental Goods: An Application to Open Space Purchase," *Land Economics*, Vol. 77, No. 4, pp. 494-512.

Science Applications International Corporation, September 2003, "Economic Analysis of the Proposed Water Quality Standards Rule for the State of Oregon," prepared for U.S. Environmental Protection Agency, Office of Water.

Seattle City Light, 2003, Habitat Conservation Plan Overview, http://www.ci.seattle.wa.us/util/About_SPU/Water_System/Habitat_Conservation_Plan--HCP/COS_001620.asp, accessed January 31, 2005.

Seattle City Light, 2003, Instream Flow Management, http://www.ci.seattle.wa.us/util/About_SPU/Water_System/Habitat_Conservation_Plan--HCP/Instream_Flow_Management/index.asp, accessed January 31, 2005.

Seattle City Light, 2003, Landsburg Mitigation, http://www.ci.seattle.wa.us/util/About_SPU/Water_System/Habitat_Conservation_Plan--HCP/Landsburg_Mitigation/index.asp, accessed January 31, 2005.

Seattle City Light, 2004, Light Impact: Cedar Falls Dam, http://www.ci.seattle.wa.us/light/environment/fish/ev5ff_cf.htm, accessed January 31, 2005.

Sequim-Dungeness Valley Agricultural Water Users Association, February 25, 2004, Comprehensive Irrigation District Management Plan.

State of Washington, Governor's Salmon Recovery Office, February 19, 2004, "Puget Sound Salmon Recovery Region," http://www.governor.wa.gov/gsro/regions/puget.htm, accessed June 30, 2004.

State of Washington, Governor's Salmon Recovery Office, February 19, 2004, "Salmon Recovery Regional Organizations," http://www.governor.wa.gov/gsro/regions.htm, accessed June 30, 2004.

Stay, Alan C., Muckleshoot Indian Tribe, Attorney, August 23, 2004, Letter to Bull Trout Coordinator, U.S. Fish and Wildlife Service.

Streiner, Carol, and John B. Loomis, October 1995, "Estimating the Benefits of Urban Stream Restoration Using the Hedonic Price Method," *Rivers*, Vol. 5, No. 4, pp. 267-278.

Tiller, Veronica E., and Robert A. Chase, 1998, "Economic Contributions of Indian Tribes to the Economy of Washington State" Bow Arrow Publishing Company.

Torell, L. A., E. Bruce Godfrey, and D. B. Nielsen, January 1986, "Forage Utilization Cost Differentials in a Ranch Operation: A Case Study," *Journal of Range Management,* Vol. 39, No. 1, pp. 34-39.

Tucker, Rob, 2000, "It's Lights out for White River Hydroelectric Plant," Foundation for Water and Energy Education, http://www.fwee.org/news/getStory?story=1198, accessed May 13, 2004.

Tyrväinen, Liisa and Antti Miettinen, March 2000, "Property Prices and Urban Forest Amenities," *Journal of Environmental Economics and Management*, 39(2), 205-223.

U.S. Army Corps of Engineers - Seattle District, Regulatory Analysis and Management (RAM) Database of Bull Trout Consultations (1998-2004).

U.S. Army Corps of Engineers, 1998 (last updated), "National Inventory of Dams," http://crunch.tec.army.mil/nid/webpages/nid.cfm.

U.S. Army Corps of Engineers, December 1998, "Economic Impacts of Environmental Windows Associated with Dredging Operations," Technical Note DOER-E3.

U.S. Census Bureau, "Annual Population Estimates 2000-2003," downloaded from http://eire.census.gov/popest/data/counties/CO-EST2003-01.php, May 11, 2004.

U.S. Census Bureau, "Ranking Tables for Counties," downloaded from http://www.census.gov/population/www/cen2000/phc-t4.html, May 12, 2004.

U.S. Census Bureau, September 2002, *Montana: 2000 Summary Population and Housing Characteristics, 2000 Census of Population and Housing,* PHC-1-28.

U.S. Census Bureau, "Small Area Income and Poverty Estimates," downloaded from http://www.census.gov/hhes/www/saipe/estimatetoc.html, May 12, 2004.

U.S. Census Bureau, Census 2000 Summary File 1, custom table retrieved from http://factfinder.census.gov.

U.S. Department of Agriculture, 2004, *2002 Census of Agriculture – County Data, Montana*, National Agricultural Statistics Service, http://www.nass.usda.gov/census/census02/volume1/mt/index2.htm.

U.S. Department of Commerce, Bureau of Economic Analysis, May 2003, *Regional Economic Information System 1969-2001*, CD-ROM.

U.S. Department of Commerce, NOAA Fisheries, November 2004, *Draft EconomicAnalysis of Critical Habitat Designation for 13 Pacific Salmon and O. mykiss ESUs.*

U.S. Department of Commerce, NOAA Fisheries Protected Resources, "Hood Canal Summer-Run ESU Chum Salmon Listing Status," http://www.nwr.noaa.gov/1salmon/salmesa/chumhcs.htm, accessed June 8, 2004.

U.S. Department of Commerce, NOAA Fisheries Protected Resources, "Puget Sound Chinook Salmon ESU Listing Status," http://www.nwr.noaa.gov/1salmon/salmesa/chinpug.htm, accessed June 8, 2004.

U.S. Department of Commerce, NOAA, March 9, 1998, "Proposed Endangered Status for Two Chinook Salmon ESUs and Proposed Threatened Status for Five Chinook Salmon ESUs; Proposed Redefinition, Threatened Status, and Revision of Critical Habitat for One Chinook Salmon ESU; Proposed Designation of Chinook Salmon Critical Habitat in California, Oregon, Washington, Idaho, Proposed Rule," *Federal Register,* Vol. 63, No. 45, pp. 11482-11520.

U.S. Department of Commerce, NOAA, March 10, 1998, "Proposed Threatened Status and Designated Critical Habitat for Hood Canal Summer-Run Chum and Salmon Columbia River Chum Salmon, Proposed Rule," *Federal Register,* Vol. 63, No. 46, pp. 11774-11795.

U.S. Department of Commerce, NOAA, March 24, 1999, "Proposed Threatened Status for Three Contiguous ESUs of Coho Salmon Ranging from Oregon through Central California, Proposed Rule," *Federal Register,* Vol. 60, No. 142, pp. 38011-38030.

U.S. Department of Commerce, NOAA, March 24, 1999, "Threatened Status for Three Chinook Salmon Evolutionarily Significant Units (ESUs) in Washington and Oregon, and Endangered Status for One Chinook Salmon ESU in Washington, Final Rule," *Federal Register*, Vol. 64, No. 56, pp. 14308-14328.

U.S. Department of Commerce, NOAA, March 25, 1999, "Threatened Status for Two ESUs of Chum Salmon in Washington and Oregon, Final Rule," *Federal Register,* Vol. 64, No. 57, pp. 14508-14717.

U.S. Department of Commerce, NOAA, April 15, 2004, "Establishment of Species of Concern List, Addition of Species to Species of Concern List, Description of Factors for Identifying Species of Concern, and Revision of Candidate Species List Under the Endangered Species Act," *Federal Register,* Vol. 69, No. 73, pp. 19975-19979.

U.S. Department of Commerce, NOAA, December 14, 2004, "Designation of Critical Habitat for 13 Evolutionarily Significant Units of Pacific Salmon (*Oncorhynchus* spp.) and Steelhead (*O. mykiss*) in Washington, Oregon, and Idaho; Proposed Rule," *Federal Register*, Vol. 69, No. 239, pp. 74572-74846.

U.S. Department of Health and Human Services, Indian Health Service, Portland Area Office, "Lummi Tribe of Indians," http://www.ihs.gov/FacilitiesServices/AreaOffices/Portland/portland-tribe-lummi.asp, accessed June 14, 2004.

U.S. Department of Labor, Bureau of Labor Statistics, May 14, 2004, Consumer Price Index, U.S. City Average.

U.S. Department of the Interior, Bureau of Land Management, "Recreation - Owyhee River: River Boating Opportunities on the Owyhee Uplands Plateau," http://www.nv.blm.gov/Elko/recreation/owyhee.htm, accessed May 27, 2004.

U.S. Department of the Interior, Bureau of Reclamation, Montana Area Office, March 2003, "North Central Montana – Alternatives Scoping Document."

U.S. Environmental Protection Agency, September 2000, *Guidelines for Preparing Economic Analyses,* EPA 240-R-00-003, http://yosemite.epa.gov/ee/epa/eed.nsf/webpages/Guidelines.html.

U.S. Environmental Protection Agency, September 26, 2003 (last updated), "Section 404 of the Clean Water Act: An Overview," http://www.epa.gov/owow/wetlands/facts/fact10.html.

U.S. Fish and Wildlife Service and National Marine Fisheries Service, March 1998, "Consultation Handbook, Procedures for Conducting Consultation and Conference Activities Under Section 7 of the Endangered Species Act," pp. xi-xii.

U.S. Fish and Wildlife Service and NOAA Fisheries, 2000, "Notice of Proposed Interagency Policy on the Prescription of Fishways under Section 18 of the Federal Power Act," *Federal Register*, Vol. 65, No. 247, pp. 80898-80904.

U.S. Fish and Wildlife Service, "Endangered Species and Habitat Conservation Planning," http://endangered.fws.gov/hcp/, accessed August 6, 2002.

U.S. Fish and Wildlife Service, "Threatened and Endangered Species database System (TESS)," http://ecos.fws. gov/tess_public/TESS, accessed July 2, 2004.

U.S. Fish and Wildlife, June 10, 1998, "Endangered and Threatened Wildlife and Plants: Proposal to List the Coastal-Puget Sound, Jarbidge River, and St. Mary-Belly River Population Segments of Bull Trout as Threatened Species," *Federal Register*, Vol. 63, No. 111, p. 31705.

U.S. Fish and Wildlife Service, April 8, 1999, "Determination of Threatened Status for the Jarbidge River Population Segment of Bull Trout, Final Rule," *Federal Register*, Vol. 64, No. 67, pp. 17110-17125.

U.S. Fish and Wildlife Service, November 1, 1999, "Determination of Threatened Status for Bull Trout in the Coterminous United States, Final Rule," *Federal Register*, Vol. 64, No. 210, pp. 58910-58933.

U.S. Fish and Wildlife, November 1, 1999, "Notice of Intent to Prepare a Proposed Special Rule Pursuant to Section 4(d) of the Endangered Species Act for Bull Trout," *Federal Register,* Vol. 64, No. 210, pp. 58934-58936.

U.S. Fish and Wildlife Service, 2002, "Chapter 25: St. Mary-Belly River Recovery Unit, Montana," in *Bull Trout (Salvelinus confluentus) Draft Recovery Plan*, Portland, Oregon.

U.S. Fish and Wildlife Service, October 2002, "ESA Basics."

U.S. Fish and Wildlife Service, 2004, "Log of Section 7 Consultations," database of historic section 7 consultations for bull trout maintained by Lacey, Washington, Field Office.

U.S. Fish and Wildlife Service, 2004, *Draft Recovery Plan for the Jarbidge River Distinct Population Segment of Bull Trout (Salvelinus confluentus)*, Portland, Oregon.

U.S. Fish and Wildlife Service, 2004, *Draft Recovery Plan for the Coastal-Puget Sound Distinct Population Segment of Bull Trout (Salvelinus confluentus),* "Volume I (of II): Puget Sound Management Unit," and "Volume II (of II): Olympic Peninsula Management Unit," Portland, Oregon.

U.S. Fish and Wildlife Service, July 19, 2004. "Proposed Designation of Critical Habitat for the Jarbidge River, Coastal-Puget Sound, and Saint Mary-Belly River Distinct Population Segments of Bull Trout, Proposed Rule" Federal Register, Vol. 69, No. 137 pp. 34058

U.S. Fish and Wildlife Service, October 6, 2004, "Designation of Critical Habitat for the Klamath River and Columbia River Populations of Bull Trout, Final Rule," *Federal Register*, Vol. 69, No. 193, p. 59996-60076.

U.S. Forest Service, "Mt. Baker-Snoqualmie National Forest: Fish Resources," http://www.fs.fed.us/r6/fishing/forests/fishresources/mtbsno_index.html, accessed June 4, 2004.

U.S. Forest Service, "Olympic National Forest: Recreation Diversity," http://www.fs.fed.us/r6/olympic/recreation/info/diversity/index.html, accessed June 4, 2004.

U.S. Forest Service, "Olympic National Forest: Recreation Facts," http://www.fs.fed.us/r6/olympic/recreation/info/facts/index.html, accessed June 4, 2004.

U.S. Forest Service, April 2003, *Jarbidge Canyon Draft Environmental Impact Statement*.

U.S. Forest Service, Humboldt-Toiyabe National Forest, April 2, 2004, "Jarbidge Canyon EIS Work Continues," News Release.

U.S. Forest Service, March 31, 2004 (last updated), "Mt. Baker-Snoqualmie National Forest: About Us," http://www.fs.fed.us/r6/mbs/about/, accessed June 4, 2004.

U.S. Forest Service, November 2003 (last updated), "Olympic National Forest Facts," http://www.fs.fed.us/r6/olympic/aboutonf/onf_facts.htm, accessed June 4, 2004.

U.S. Forest Service, "1999 Ten-Percent Fund Project Summary: Upper East Fork Jarbidge Watershed Road Enhancement (Pole Creek Road). Fax communication with Craig Newman, USFS Engineer, Humboldt-Toiyabe National Forest, September 10, 2004.

U.S. Office of Management and Budget, September 17, 2003, "Circular A-4," http://www.whitehouse.gov/omb/circulars/a004/a-4.pdf.

U.S. Small Business Administration, Office of Advocacy, July 2004, "Firm Size Data: Statistics of U.S. Businesses and Nonemployer Statistics," http://www.sba.gov/ADVO/stats/data.html.

U.S. Small Business Administration, Office of Advocacy, May 2003, "A Guide for Government Agencies: How to Comply with the Regulatory Flexibility Act."

Washington Administrative Code 365-195-900, August 25, 2003 "Background and Purpose."

Washington Department of Community, Trade, and Economic Development, Growth Management Services, undated, “The Washington State Growth Management Act: An Overview,” pamphlet.

Washington Department of Community, Trade, and Economic Development, December 5, 2003, “GMA Update: Issues to Consider When Reviewing Comprehensive Plans and Development Regulations,” http://www.cted.wa.gov/DesktopDefault.aspx?TabId=721, accessed May 25, 2004.

Washington Department of Community, Trade, and Economic Development, December 5, 2003, “GMA Update: Issues to Consider When Reviewing Comprehensive Plans and Development Regulations,” http://www.cted.wa.gov/DesktopModules/Documents/ViewDocument.aspx?DocumentID=982, accessed May 25, 2004.

Washington Department of Community, Trade, and Economic Development, December 5, 2003, “GMA Update: Issues to Consider When Reviewing and Evaluating Critical Areas Regulations and Natural Resource Lands Designations,” http://www.cted.wa.gov/DesktopModules/Documents/ViewDocument.aspx?DocumentID=981, accessed May 25, 2004.

Washington Department of Ecology, “Dam Safety Office,” http://www.ecy.wa.gov/programs/wr/dams/dss.html, accessed June 23, 2004.

Washington Department of Ecology, GIS data for surface water quality standards, 2003 Use Classification Standards. Personal communication, Andrew Kolosseus, May 17, 2004.

Washington Department of Ecology, Water Quality Permit Life Cycle System (WPLCS), http://www.ecy.wa.gov/programs/wq/permits/wplcs/index.html (as of 2004).

Washington Department of Ecology, August 25, 2003, “Water Right Leases Help Increase Streamflows in the Dungeness,” press release.

Washington Department of Ecology, January 2003, “Washington Water Acquisition Program.”

Washington Department of Ecology, “Introduction to the Shoreline Management Act,” http://www.ecy.wa.gov/programs/sea/SMA/st_guide/intro.html, accessed September 9, 2004.

Washington Department of Ecology, “About Stormwater,” http://www.ecy.wa.gov/programs/wq/stormwater/municipal/gen_info.html, accessed September 9, 2004.

Washington Department of Ecology, Water Quality Program, August 2001, *Stormwater Management Manual for Western Washington*, Publication Numbers 99-11 through 99-15.

Washington Department of Ecology, Proposed Stormwater Management Manual Revisions, http://www.ecy.wa.gov/programs/wq/stormwater/WW%20Stormwater%20Manual/Manual_update_changes.htm, accessed February 1, 2005.

Washington Department of Fish and Wildlife, "Hydraulic Project Approval (HPA)," http://wdfw.wa.gov/hab/hpapage.htm, accessed May 26, 2004.

Washington Department of Fish and Wildlife, "Screening Requirements for Water Diversions," http://wdfw.wa. gov/hab/engineer/fishscrn.htm, accessed May 28, 2004.

Washington Department of Fish and Wildlife, May 2003, "Design of Road Culverts for Fish Passage – 2003," http://wdfw.wa.gov/hab/engineer/cm/culvert_manual_final.pdf.

Washington Department of Fish and Wildlife, Science Division, Habitat Program, 2004, "WDFW Fish Passage and Diversion Screening Inventory - Dams without Fishways."

Washington Department of Fish and Wildlife, Washington Department of Transportation, and Washington Department of Ecology, April 2003, *Integrated Streambank Protection Guidelines,* http://wdfw.wa.gov/hab/ahg/ispgdoc.htm

Washington Department of Fish and Wildlife, GAP Analysis Land Coverage (GIS Coverage), http://www.wdfw.wa.gov/wlm/gap/dataprod.htm

Washington Department of Natural Resources, March 2004 (last updated), "Forest Practices Legislation and Rule Making History," http://www.dnr.wa.gov/forestpractices/rules/history3-17-04.pdf, accessed June 17, 2004.

Washington Department of Transportation, April 2004, "Progress Performance Report for WDOT Fish Passage Inventory."

Washington Department of Transportation, GIS Coverage for Historic Road Projects 1998 – 2004.

Washington Department of Transportation, GIS Coverage for Future Road Projects 2004 – 2009

Washington Department of Transportation, Waterbodies and Watersheds Eligible for Proposed Stormwater Exemption for "Flow Control," http://www.wsdot.wa.gov/environment/wqec/docs/TC_PostPub_HRM_Table2.5_120604.pdf.

Washington Employment Security Department, Labor Market and Economic Analysis, December 2001, *Clallam County Profile.*

Washington Employment Security Department, Labor Market and Economic Analysis, April 2002, *Grays Harbor and Pacific Counties Profile.*

Washington Employment Security Department, Labor Market and Economic Analysis, April 2000, *Island County Profile.*

Washington Employment Security Department, Labor Market and Economic Analysis, July 2000, *Jefferson County Profile.*

Washington Employment Security Department, Labor Market and Economic Analysis, March 2001, *King County Profile.*

Washington Employment Security Department, Labor Market and Economic Analysis, March 2002, *Mason County Profile.*

Washington Employment Security Department, Labor Market and Economic Analysis, March 2001, *Pierce County Profile.*

Washington Employment Security Department, Labor Market and Economic Analysis, January 2002, *Skagit County Profile.*

Washington Employment Security Department, Labor Market and Economic Analysis, April 2001, *Snohomish County Profile.*

Washington Employment Security Department, Labor Market and Economic Analysis, December 1999, *Thurston County Profile.*

Washington Employment Security Department, Labor Market and Economic Analysis, March 2001, *Whatcom County Profile.*

Weicher, J.C. and R.H. Zerbst, February 1973, "The Externalities of Neighborhood Parks: An Empirical Investigation," *Land Economics*, Vol. 49, 99-105.

Westside Stormwater Group, December 1, 2003, *Report to the Washington Department of Ecology*.

Whiteing, Jeanne S., Attorney for the Blackfeet Tribe of the Blackfeet Indian Reservation, August 24, 2004, Letter to the Bull Trout Coordinator, U.S. Fish and Wildlife Service.

Wilderness.net, "Jarbidge Wilderness," http://www.wilderness.net/index.cfm?fuse=NWPS&sec=wildView&WID=274&tab=General, accessed June 5, 2004.

Wildernet, “Nevada: Jarbidge Ranger District,” http://areas.wildernet.com/pages/area.cfm?areaID=040902&CU_ID=1, accessed May 27, 2004.

Wu, Junjie, Richard Adams, and Andrew Plantinga, February 2004, “Amenities in an Urban Equilibrium Model: Residential Development in Portland, Oregon,” *Land Economics,* Vol. 80, No. 1, pp. 19-32.

Personal communication with:

Alan Morris, consultant to Atna Resources, Reno, Nevada, September 9, 2004.

Alice McConnahan, Manager, Environmental Department, Port Townsend Paper, Port Townsend, Washington, June 4, 2004.

Andrew Graham, HDR/EES, Olympia, Washington, February 4, February 7, February 8, February 9, February 10, and February 11, 2005.

Ann Uhrich, North Section Chief, U.S. Army Corps of Engineers – Seattle District, Regulatory Division, June 8, 2004.

Barb Seekins, NOAA Fisheries GIS Analyst, January 21, 2005.

Bill Freymond, Washington Department of Fish and Wildlife, May 28, 2004.

Bill Michels, Biologist, National Park Service, Glacier National Park, June 24, 2004.

Bill Thibadeau, Project Manager, Operations, Mud Mountain Dam, U.S. Army Corps of Engineers, Seattle District, Seattle, Washington, May 27, 2004.

Biologist with PacifiCorp, Portland, Oregon, December 2003.

Bob Montgomery, Montgomery Water Group, Kirkland, Washington, February 7, 2004.

Brad Feilberg, City Engineer, City of Monroe, Washington, June 1, 2004.

Brian Benson, Information Technology Application Specialist, Washington Department of Fish and Wildlife, June 22, 2004, and February 11, 2005.

Brian Winter, Project Manager, Elwha Restoration Project, National Park Service, Port Angeles, Washington, June 8, 2004.

Bruce Chattin, Executive Director, Washington Aggregates and Concrete Association, June 10, 2004.

Bruce Lippke, Professor, University of Washington, College of Forest Resources, July 24, 2003.

Bryan Nordlund, Hydraulic Engineer, NOAA Fisheries, Northwest Region, Hydropower Division, May 2004.

Burt Brackett, private rancher, May 2004.

Butch Smith, Jarbidge Community Advisory Board, May 18, 2004.

Carol Brown, Sawtooth National Forest, March 10, 2004.

Carol Piening, ESA Compliance Team Leader, Washington State Aquatic Resource Program, Olympia, Washington, February 3, 8, 10, 2005.

Chet Bracket, private rancher, May 2004.

Chris Hansen-Murray, Forester, Mt. Baker-Snoqualmie National Forest, July 25, 2004.

Chris Pihl, Owner, May Creek Power, Woodinville, Washington, June 3, 2004.

City of Seattle, Seattle Public Utilities, June 2001.

Craig Newman, USFS Engineer, Humboldt-Toiyabe National Forest, September 10, 2004.

Cyndy Holtz, HCP Program Manager, Seattle Public Utilities, June 16, June 23, and June 29, 2004.

Cynthia Nelson, Washington Department of Ecology, Water Resources Program, May 2004.

Dave Clouse, Biologist, Fort Lewis, U.S. Army, Department of Defense, June 7, 2004.

Dave Fillippi, Stoel Rives, July 1, 2004.

Dave Pflug, Fisheries Scientist, Seattle City Light, June 2 and 4, 2004, and February 4, and March 17, 2005.

David Leegard, Nevada Department of Transportation, June 1, 2004.

David Norman, Assistant State Geologist, Washington Department of Natural Resources, Division of Geology and Earth Resources, May 26, 2004.

Dru Butterfield, Park Manager, Hiram M. Chittenden Locks, U.S. Army Corps of Engineers, Seattle District, Seattle, Washington, June 3, 2004.

Ed O'Brien, Washington Department of Ecology, Olympia, Washington, June 1, 2004, and February 1, 2, 2005.

Eric Egbers, Washington Department of Fish and Wildlife, May 2004.

Gary Johnson, Nevada Department of Wildlife, May 18, 2004.

Gayle Kreitman, Regulatory Services Section Manager, Washington Department of Fish and Wildlife, June 2004.

George Boucher, Engineer (Retired), Elko County Manager, May 18, 2004.

George Hart, Biologist, U.S. Army Corps of Engineers – Seattle District, June 2004

GIS Analyst, Western Washington Fish and Wildlife Office, Lacey, Washington January 27, 2005.

Glen Mixdorf, Assistant General Council, General Council's Office, Snohomish County Public Utilities District, Everett, Washington, February 7, 2005.

HCP Division Manager, Western Washington Fish and Wildlife Office, Lacey, Washington, January 31, 2005.

HCP Manager, City of Seattle, July 2004.

Jack Creechley, Owner, Outdoor Inn, Jarbidge, Nevada, May 18, 2004.

Jacque Dean, Engineer, Kitsap County Public Works Department, August 3, 2004.

Jane Hewitt, Grays Harbor County Planning Department, June 9, 2004.

Jeff Dillon, Fishery Biologist, Environmental Resources Section, U.S. Army Corps of Engineers, Seattle District, Seattle, Washington, May 27, 2004.

Jim Klott, Wildlife Biologist, Bureau of Land Management, Twin Falls, Idaho, May, and September 10, 2004.

Jim Winfrey, USFS Roads Manager, Humboldt-Toiyabe, May 10, 2004.

Joe Kelly, Idaho Department of Fish and Game, September 19, 2004.

John Ives, Principal, Jones and Stokes, Bellevue, Washington, February 1, 2005.

Karen Chang, Biologist, Darrington Ranger District, Mt. Baker-Snoqualmie National Forest, Darrington, Washington, June 3, 2004.

Kelly Peterson, Environmental Engineer, Wellhead Protection, City of Kent, Washington. February 9, 2005.

Krinn McCoy, Owner, Tsawhawbitts Bed and Breakfast, May 18, 2004.

Kurt Crawford, King County Growth Management, February 1, 2005.

Larry Donovan, Mount Baker-Snoqualmie National Forest, June 10, 2004.

Larry Schaffner, Washington Department of Transportation, February 1, 2005

Lee LeRue, Foreman, Mount Ranier National Park, June 3, 2004.

Linda Matlock, WDOE Water Quality Program, Stormwater Unit Manager, Lacey, Washington, November 17, 2004.

Liz Ablo, Senior Environmental Analyst, Seattle City Light, February 4, 2005.

Lowell Prunty, Owner, Jarbidge Wilderness Guide and Packing, February 11, 2005.

Margaret Wood, Humboldt-Toyaibe National Forest, May 18, 2004.

Mark Bruskiewicz, Washington Department of Transportation, February 2, 2005

Mark Downen, Washington Department of Fish and Wildlife, May 28, 2004.

Mark Gamblin, State Fishery Manager, Idaho Fish and Game, February 11, 2005

Mary Ullrich, GIS Analyst, King County GIS Center, Department of Natural Resources and Parks, Wastewater Treatment Division, Seattle, Washington. February 11, 2005.

Max Yingst, Bureau of Land Management, 2004.

Michelle Blake, GIS Analyst, Washington Department of Transportation, June 15, 2004.

Michelle Walker, U.S. Army Corps of Engineers, May 14, 2004.

Mike Jeldness, Coordinator, Sequim-Dungeness Agricultural Water Users, February 10, 2005.

Mike Padilla, Project Manager, Wynoochee Dam Fish Restoration Project, U.S. Army Corps of Engineers Seattle District, Seattle, Washington, May 27, 2004.

Mike Shelby, Manager, Western Washington Agricultural Association, May 2004.

National Park Service staff, June 10, 2004.

Pat McCarty, Manager, Generation Business Unit, Tacoma Power, Tacoma, Washington, June 2, and June 3, 2004.

Pat Morin, Database Manager, Washington Department of Transportation, June 18, 2004.

Patricia Graesser, Public Affairs Specialist, Public Affairs Office, U.S. Army Corps of Engineers, Seattle District Office, Seattle, Washington, June 7, 2004.

Paul Hayduk, Hatchery Manager, Quinault National Fish Hatchery, Humptulips, Washington, February 3, 2005.

Paul Hickey, HCP Manager, City of Tacoma, June 1, and June 15, 2004.

Peter Grubb, River Odyssey West (Jarbidge Rafting Guide Service), February 11, 2005.

Peter Skowlund, Washington Department of Ecology, May 27, 2004.

Phil Bloch, Natural Resource Scientist, Endangered Species Act Planning and Biological Assessment, Aquatics Reserve Program, Washington Department of Natural Resources, Olympia, Washington, February 3 and February 15, 2005.

Portland General Electric, Portland, Oregon, December 2003.

Reed Glesne, Biologist, North Cascades National Park, May 18, 2004.

Richard Geiger, Engineer, Mason County Conservation District, June 17, and August 4, 2004.

Rick Parker, Hydropower Manager, Elwha Restoration Project, Bureau of Reclamation, Port Angeles, Washington, June 2, 2004.

Roger Thompson, Corporate Communications Manager, Puget Sound Energy, Bellevue, Washington, May 26, 2004.

Sam Brenkman, Biologist, Olympic National Park, May 18, 2004.

Scott Guenthner, Hydrologist, U.S. Bureau of Reclamation, Billings, Montana, June 10, 2004.

Scott Pozaryski, Biologist, Environmental Resources Section, U.S. Army Corps of Engineers, Seattle District, Seattle, Washington, May 27, 2004.

Service Biologist, Montana Ecological Services, Helena Field Office, Helena, Montana, June 8, 2004.

Service Biologist, Montana Fish and Wildlife Management Assistance Office, Bozeman, Montana, June 9, 2004.

Service Biologist, Nevada Fish and Wildlife Office, Reno, Nevada, May, July 1, September 14, and October 14, and December 1, 2004.

Service Biologist, Nevada Fish and Wildlife Office, Reno, Nevada, December 1, 2004.

Service Biologist, Olympia, Washington, February 1, 2005.

Service Biologist, Western Washington Fish and Wildlife Office, Lacey, Washington, May, June 10, June 17, and June 18, 2004, and January 27January 31, February 1, February 2, and February 3, 2005.

Service GIS Analyst, Western Washington Fish and Wildlife Office, Lacey, Washington, May 20, 2004.

Service Section 6 Grants Program Personnel, Olympia, Washington, February 3, 2005.

Steve Bellcoff, Manager, Hydro Site Database, Bonneville Power Administration, Portland, Oregon, January 3, 2005.

Steve Fischer, Project Manager, Wynoochee Dam Fish Restoration Project, Tacoma Public Utilities, Tacoma, Washington, June 3, 7, 2004.

Steve Gilbert, HCP Project Manager, King County Wastewater Treatment Division, May 3, 2004, and February 1, February 3, and February 7, 2005.

Steve Stone, NOAA Fisheries Biologist, January 21, 2005.

Sue Camp, Natural Resource Specialist, U.S. Bureau of Reclamation, Montana Area Office, June 2, 2004.

Tom Creegan, Engineer, King County Roads Department, August 3, 2004.

William Wolinski, Environmental Engineering Manager, City of Kent, Washington. February 11, 2005.

Zeda Williams, Manager of Operations, Snohomish Public Utilities District, Everett, Washington, June 3, 2004.

APPENDIX A:
ECONOMIC EFFECTS TO SMALL ENTITIES AND ENERGY

Appendix A is included in a separate file.

COSTS OF DEVELOPMENT RESTRICTIONS

When development is prohibited in certain areas as a result of species conservation, it may reduce the value of the affected land. This reduction in property value represents a cost to landowners. There are two classes of models that economists use to evaluate such costs. One is the "closed city model" and the other is the "open city model." The closed city model assumes that the number of households in a city is fixed and migration does not occur when economic conditions change in the city. The open city model assumes that the number of households in a city is determined in a multi-city equilibrium. Therefore, households are free to move from one city to another, and will choose their residential place to maximize their utility. Given that housing markets in U.S. cities feature a large volume of in- and out-migration, the open city model seems to provide a more accurate and realistic description of the development process in the Puget Sound region. Based on this premise and technical reviewers' comments on previous analyses of CHD, the open city model is judged to be appropriate to measure the cost associated with land use restrictions, should such restrictions arise with conservation activities for bull trout. The assessments of CHD in this analysis model household and landowner decisions by expanding the stochastic city model developed by Capazza and Helsley (1990). To provide an overview of how this type of model can be implemented in the case of an effect on land values, the following description of key relationships is provided. As in Capazza and Helsley (1990), this analysis assumes that there is an identifiable Central Business District (CBD), to which all households commute daily. Locations are indexed by their distance from the CBD (z).

In a competitive market, the price of land equals the expected present value of future land rents. Specifically, the price of agricultural land at a given location equals the present value of agricultural rent up to the time of conversion plus the present value of urban rent from the time of conversion onward. Assuming that landowners choose the conversion time to maximize the expected value of land the price of agricultural land is derived as follows:

$$\text{(A1)} \qquad P^a(t,z) = \frac{R_a}{r} + \frac{g}{r^2} e^{-\alpha(z^*-z)} + \frac{r-\alpha g}{\alpha r^2} e^{-\alpha(z^*-z)}$$

$R_a =$ the rent of agricultural land

$r =$ the discount rate

$g =$ income growth rate

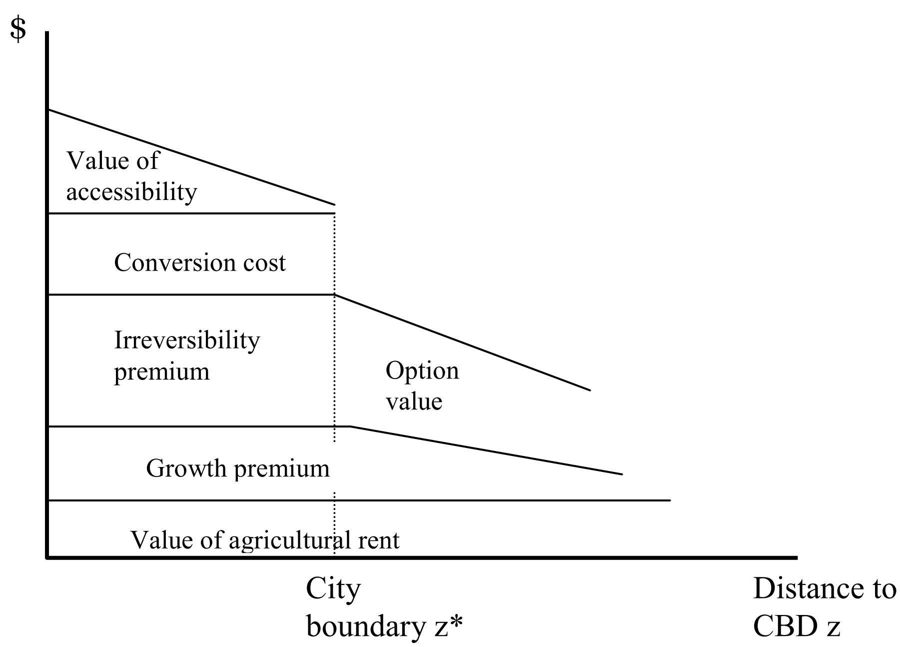
$z^* =$ the distance from the city boundary to the city center

The price of agricultural land has three components. Capazza and Helsley (1990) refer to these components as (1) the value of agricultural rents, (2) growth premium, and (3) option value of potential development. Both the growth premium and the option value decrease as the distance from the boundary of the urban area increases and the time of development moves further into the future. Both also decrease as the property tax rate increases. The price of urban land can be derived as:

$$\text{(A2)} \qquad P^u(t,z) = \frac{1}{r}\left\{ R_a + rC + \frac{g}{r} + \frac{r-\alpha g}{\alpha r} + \frac{z^*(t)-z}{(1+\tau_{t})} \right\}$$

In this formula, C is the capital cost of converting a unit of land to urban use. The price of urban land consists of the value of agricultural rents, the cost of conversion, the growth premium, the irreversibility premium, and the value of accessibility. Graphically, the prices of urban and agricultural land are illustrated as follows in Figure B-1:

Figure B-1
Graphical Representation of the Components of Land Price (Value)



Consider the cost of land use restrictions due to a CHD to landowners in the following scenarios:

a) A piece of agricultural land is prohibited from being farmed or developed in the future. The cost to the landowner is given by (A1).

b) A piece of agricultural land is prohibited from being developed in the future, but can be farmed. The cost to landowner in this case is given by:

$$\left[P^a(t,z)-\frac{A}{r}\right]=\frac{g}{r^2}e^{-\alpha(z^*-z)}+\frac{r-\alpha g}{\alpha r^2}e^{-\alpha(z^*-z)}$$

c) A piece of urban land is prohibited from being farmed or developed. The cost to landowner is given by (A2).

COST OF PROJECT MODIFICATIONS TO RESIDENTIAL AND COMMERCIAL DEVELOPMENT

The net present value approach is used to measure the cost of project modifications to past and future developments that may be associated with designation of critical habitat. This approach allows us to estimate the cost by different types of development (e.g., commercial, residential) and by region (e.g., a particular river basin). The framework requires several pieces of information, including: a) projected acres of each type of development in each HUC containing proposed critical habitat, b) percent of development actually "burdened" by the requirements, and c) per-acre costs of project modification for the "burdened" development. With these data, the prospective cost of CHD for commercial and residential development during a given time period (e.g., from 2005 to 2024) can be estimated by the following formula, where total cost (TC) is measured in 2004 dollars:

(A3) $$TC=\sum_{t=2005}^{2024}\sum_{i=1}^{I}\frac{A_t^i S_t^i C_t^i}{(1+r)^{t-2005}}$$

$i =$ types of development (low-density residential, high-density residential, 1-acre commercial, 10-acre commercial, mixed development, etc.)

A_t^i = projected acres of type *i* development in year *t*

S_t^i = percent of type-*i* development actually burdened

C_t^i = per-acre or per unit project modification cost

$r=$ discount rate

Likewise, the retrospective cost of habitat designation for commercial and residential development during a given time period (e.g., from 1998 to 2004) can be estimated by the following formula, where the retrospective cost is also measured in 2004 dollars:

(A4) $$TC=\sum_{t=1998}^{2004}\sum_{i=1}^{I}[A_t^i S_t^i C_t^i(1+r)^{2004-t}]$$

Appendix C is included in a separate file.

APPENDIX D: DETAILED ESTIMATES OF ECONOMIC EFFECTS BY HUC IN JARBIDGE RIVER

Appendix D is included in a separate file.

Appendix E:
List of Acronyms

BLM	Bureau of Land Management
BPA	Bonneville Power Administration
CHD	Critical Habitat Designation
CHSU	Critical Habitat Subunit
CPI	Consumer Price Index
CREP	Conservation Reserve Enhancement Program
EA	Environmental Assessment
ESA	Endangered Species Act of 1973 (Act)
ESU	Evolutionary Significant Unit
FERC	Federal Energy Regulatory Commission
FHWA	Federal Highway Administration
FMO	Foraging, Migrating, and Overwintering
FMP	Forest Management Plan
FONSI	Finding of No Significant Impact
FPA	Federal Power Act
GIS	Geographic Information Systems
HCP	Habitat Conservation Plan
HPA	Hydraulic Project Approvals
HUC	Hydrologic Unit Code
ICBEMP	Interior Columbia Basin Ecosystem Management Project
IJC	International Joint Commission
MBTRT	Montana Bull Trout Restoration Team
NDOT	Nevada Department of Transportation
NDOW	Nevada Department of Wildlife

NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resource Conservation Service
NWFP	Northwest Forest Plan
O&M	Operations and Maintenance
OHV	Off Highway Vehicle
OMB	Office of Management and Budget
RCW	Revised Code of Washington
RFA	Regulatory Flexibility Act
RMZ	Riparian Management Zone
ROD	Record of Decision
SBA	U.S. Small Business Administration
SBREFA	Small Business Regulatory Enforcement Fairness Act
SMA	Shoreline Management Act
SOPA	Schedule of Proposed Actions
SWPPP	Stormwater Pollution Prevention Plan
TMP	Temperature Management Plan
UGA	Urban Growth Areas
USACE	U.S. Army Corps of Engineers
USBR	U.S. Bureau of Reclamation
USFS	U.S. Forest Service
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WDNR	Washington Department of Natural Resources
WDOT	Washington Department of Transportation
WDOE	Washington Department of Ecology