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ECONOMIC ANALYSIS OF CRITICAL HABITAT DESIGNATION FOR THE SPIKEDACE AND LOACH MINNOW

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prepared for:

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

CHAPTER 1 FRAMEWORK FOR ANALYSIS 1-1

1.1 Approach to Estimating Economic Effects 1-2

1.1.1 Efficiency Effects 1-2

1.1.2 Distributional and Regional Economic Effects 1-3

1.2 Scope of the Analysis 1-5

1.2.1 Sections of the Act Relevant to the Analysis 1-6

1.2.2 Other Relevant Protection Efforts 1-7

1.2.3 Additional Analytic Considerations 1-7

1.2.4 Benefits 1-8

1.2.5 Geographic Scope of the Analysis 1-9

1.3 Analytic Time Frame 1-9

1.4 Information Sources 1-9

1.5 Structure of Report 1-10

CHAPTER 2 BACKGROUND AND SOCIOECONOMIC OVERVIEW 2-1

2.1 Proposed Critical Habitat Designation 2-1

2.2 Threats to the Species and its Habitat 2-3

2.3 Socioeconomic Profile of the Critical Habitat Area 2-5

2.3.1 Population Characteristics 2-5

2.3.2 Economic Activity 2-7

CHAPTER 3 POTENTIAL ECONOMIC IMPACTS TO WATER MANAGEMENT AND USE 3-1

3.1 Summary of Impacts 3-1

3.2 Approach to Analysis of Water Management and Use 3-4

3.3 Past Impacts on Water Use in Proposed CHD Areas 3-7

3.4 Identification of Water Users in Proposed CHD Areas 3-9

3.5 Identifying Future Economic Impacts Related to Water Supply 3-13

3.5.1 Complex 1: Verde River Complex 3-14

3.5.2 Complex 2: Black River Complex 3-17

3.5.3 Complex 3: Middle Gila/Lower San Pedro/Aravaipa Creek Complex 3-17

3.5.4 Complex 4: San Francisco/Blue River Complex 3-18

3.5.5 Complex 5: Upper Gila River 3-19

3.6 Summary of Water Use Impacts due to Spikedace and Loach Minnow 3-20

CHAPTER 4 POTENTIAL ECONOMIC IMPACTS TO LIVESTOCK GRAZING ACTIVITIES *4-1*

4.1 Summary of Impacts to Grazing *4-1*

4.2 Background *4-6*

4.2.1 AUMs and Permit Value on Federal Lands *4-6*

4.2.2 Factors Affecting Permitted and Authorized AUMs *4-9*

4.3 Past Costs from Grazing *4-11*

4.3.1 Administrative Costs *4-11*

4.3.2 Previous Reductions in Grazing Effort *4-11*

4.3 Future Costs to Grazing Activities *4-15*

CHAPTER 5 POTENTIAL ECONOMIC IMPACTS TO MINING OPERATIONS *5-1*

5.1 Summary of Potential Impacts to Mining Activities *5-1*

5.2 Potential Impacts to Mining Operations *5-2*

5.3 Overview of Mining Activities in Critical Habitat Areas *5-2*

5.4 Past Economic Impacts on Mining Activities *5-3*

5.5 Future Economic Impacts on Mining Activities *5-3*

5.5.1 Potential Impacts to Phelps Dodge Corporation *5-5*

5.5.2 Potential Impacts to ASARCO, Inc. *5-8*

5.6 Summary of Impacts *5-9*

CHAPTER 6 POTENTIAL COSTS OF SPECIES MANAGEMENT ACTIONS, INCLUDING ECONOMIC IMPACTS TO RECREATION *6-1*

6.1 Summary of Costs of Species Management Actions *6-1*

6.1.1 Past Costs *6-1*

6.1.2 Future Costs *6-2*

6.2 Overview of Fish Management Actions in Critical Habitat Areas *6-6*

6.3 Overview of Recreation Activities in Critical Habitat Areas *6-6*

6.3.1 Fishing *6-6*

6.3.2 Off-Highway Vehicle Use *6-8*

6.4 Costs of Fish Management and Economic Impacts on Recreation Activities *6-9*

6.4.1 Cost of Fish Management Actions *6-10*

6.4.2 Recreational Fishing Impacts *6-10*

6.4.3 OHV Use *6-13*

CHAPTER 7 POTENTIAL ECONOMIC IMPACTS TO RESIDENTIAL AND COMMERCIAL DEVELOPMENT 7-1
7.1 Summary of Economic Impacts 7-1
7.2 Analytical Approach 7-2
7.3 Past Economic Impacts 7-3
7.4 Potential Future Economic Impacts 7-5
7.4.1 Complex 1: Verde River 7-10
CHAPTER 8 POTENTIAL ECONOMIC IMPACTS TO TRIBES 8-1
8.1 Introduction 8-1
8.2 Summary of Impacts to Tribes 8-2
8.3 Background and Socioeconomic Status of Potentially Affected Tribes 8-2
8.4 Yavapai-Apache Nation 8-4
8.4.1 Yavapai-Apache Socioeconomic Status 8-6
8.4.2 Yavapai-Apache Potentially Affected Activities 8-6
8.5 White Mountain Apache 8-7
8.5.1 White Mountain Apache Socioeconomic Status 8-7
8.5.2 White Mountain Apache Potentially Affected Activities 8-9
8.6 San Carlos Apache 8-10
8.6.1 San Carlos Apache Socioeconomic Status 8-10
8.6.2 San Carlos Apache Potentially Affected Activities 8-11
CHAPTER 9 POTENTIAL ECONOMIC IMPACTS TO TRANSPORTATION ACTIVITIES 9-1
9.1 Summary of Impacts to Transportation Activities 9-1
9.2 Past Economic Impacts to Transportation Activities 9-1
9.3 Future Economic Impacts on Transportation Activities 9-6
CHAPTER 10 POTENTIAL ECONOMIC IMPACTS TO FIRE MANAGEMENT ACTIVITIES 10-1
10.1 Background and Summary of Past Fire Management Impacts 10-2
10.2 Summary of Future Fire Management Impacts 10-3
REFERENCES R-1

APPENDIX A ADMINISTRATIVE COSTS *A-1*

APPENDIX B SMALL BUSINESS AND ENERGY IMPACTS ANALYSIS *B-1*

APPENDIX C DETAILED COST ESTIMATES OF GRAZING IMPACTS PRESENTED BY ALLOTMENT *C-1*

APPENDIX D SUMMARY OF QUANTIFIED FUTURE COSTS BY RIVER SEGMENT IN PROPOSED CHD, 2006-2025 *D-1*

EXECUTIVE SUMMARY

1. The purpose of this report is to identify and analyze the potential economic impacts associated with the proposed critical habitat designation for the federally listed *Meda fulgida* (spikedace) and *Tiaroga cobitis* (loach minnow). This report was prepared by Industrial Economics, Incorporated (IEc), under contract to the U.S. Fish and Wildlife Service's (Service) Division of Economics.

2. On December 20, 2005, the U.S. Fish and Wildlife Service (Service) published a proposed critical habitat designation (CHD) for the spikedace and loach minnow. The Service has proposed to designate critical habitat for these species on approximately 633 miles of stream in Arizona and New Mexico. Critical habitat includes the wetted channel and adjacent floodplains within 300 lateral feet on either side of the bankfull stage.[1] The proposed CHD is subdivided into five river complexes and 25 stream segments. Of the stream miles proposed, approximately 58 percent are Federal lands (managed by the Bureau of Land Management, the Bureau of Reclamation or the Forest Service), 35 percent are privately owned, five percent are Tribal lands, and two percent are State lands. Lands of the San Carlos Apache Tribe (17.2 stream miles) and White Mountain Apache Tribe (12.5 stream miles) are proposed for exclusion from CHD.

3. Undiscounted costs are estimated to be $25.2 million to $100.3 million over 20 years. Discounted future costs are estimated to be $13.9 to $69.2 million over this same time period ($1.4 million to $6.7 million annually) using a real rate of seven percent, or $19.0 to $83.6 million ($1.3 to $5.7 million annually) using a real rate of three percent.[2] This analysis forecasts potential impacts on several economic activities, including water diversion repair, livestock grazing, recreation, species management, residential and commercial development, and transportation, as well as administrative costs associated with species conservation activities. In addition, potential impacts on water users are considered. However, there are currently no data that indicate whether existing or future

[1] Note that this analysis presents only approximate estimates of land acreage included in critical habitat areas. Using GIS (Geographic Information Systems) data, acreage is approximated by creating a buffer of 300 feet on either side of the proposed CHD centerline developed by the Service. Please refer to the proposed rule for legal descriptions of proposed CHD.

[2] Cost estimates are also summarized in Appendix D. Guidance provided by the OMB specifies the use of a real rate of seven percent. In addition, OMB recommends sensitivity analysis using other discount rates such as three percent, which some economists believe better reflects the social rate of time preference. (U.S. Office of Management and Budget, Circular A-4, September 17, 2003 and U.S. Office of Management and Budget, "Draft 2003 Report to Congress on the Costs and Benefits of Federal Regulations; Notice," 68 *Federal Register* 5492, Feb. 3, 2003.)

KEY FINDINGS

- **Total Future Impacts**: Quantified economic impacts are estimated to be $25.2 million to $100.3 million over 20 years (undiscounted). Discounted future costs are estimated to be $13.9 to $69.2 million over this same time period ($1.4 million to $6.7 million annually) using a real rate of seven percent, or $19.0 to $83.6 million ($1.3 to $5.7 million annually) using a real rate of three percent. In addition, the analysis presents information regarding which stream segments could experience impacts related to changes in water availability for municipal, agricultural, Tribal, and mining use. Impacts to fire management activities are also presented.
- **Affected Activities:** Water-related costs comprise about half of total quantified future impacts, and species management (including removal of nonnative species) and recreation costs comprise about one-quarter of estimated costs (using upper bound estimates). Other quantified impacts include livestock grazing (11 percent), residential/commercial development (seven percent), administrative costs (four percent), and transportation (one percent).
    - Water use/management: Undiscounted costs are estimated to be $0.3 million to $39 million over 20 years, or $0.16 to $36.1 assuming a seven percent discount rate, and $0.2 to $37.6 million assuming a three percent discount rate. Impacts include costs of compliance with project modifications including habitat restoration and species monitoring, and, in high end estimates, costs if 6,310 acres of agricultural croplands are retired to provide water for the fish. However, potential impacts on municipal, Tribal, and industrial (mining) water use are uncertain. Concerns include possible impacts on municipal groundwater diversions by communities of the Verde Valley and the City of Prescott; water use by the San Carlos Apache, Yavapai Apache, and White Mountain Apache Tribes; and mining at four major copper mines that divert water from proposed CHD.
    - Mining: The mining industry has expressed concern that water use by existing or potential mining operations could be affected by endangered species conservation activities. Five large mining resources could be affected if species requirements result in changes in water diversions or conveyance for mining activities.
    - Tribes: Lands of the Yavapai-Apache Nation, San Carlos Apache Tribe, and White Mountain Apache Tribe fall in proposed CHD. The lands of the San Carlos and White Mountain Apache have been proposed for exclusion. The Tribes are concerned that critical habitat on Reservation lands will have a disproportionate impact on their ability to use resources on their sovereign lands and to successfully achieve economic self-sufficiency.
    - Species management and Recreation: Undiscounted species management costs are estimated to $14.7 to $14.9 million over 20 years, or approximately $8.4 to $8.5 million (discounted at seven percent), and $11.2 to $11.5 million (discounted at three percent). Costs include installation of nonnative fish barriers, as well as an extensive program for monitoring and removal of nonnative fish. Potential impacts on recreation activities include lost angler days estimated at $0 to $16.3 million in undiscounted dollars, $0 to $8.6 million (discounted at seven percent), or $0 to $12.1 million (discounted at three percent).
    - Livestock Grazing: Costs related to grazing management are estimated to range from $0.7 to $14 million (undiscounted), $0.3 to $7.4 million (discounted at seven percent), or $0.4 to $10.4 million (discounted at three percent), and primarily include fence maintenance costs. Approximately 76 ranches, or 4.7 percent of ranches in counties that contain proposed CHD, could be impacted by conservation activities, assuming that one ranch is responsible for each affected allotment.
    - Residential/Commercial Development: Future impacts to development activities are estimated to range from $6.4 to $9.8 million (undiscounted), $3.4 to $5.2 million (discounted at seven percent), or $4.8 to $7.3 million (discounted at three percent). Costs consist of monitoring, studies, and offsite mitigation that may be required of new development activity on private land.
    - Administrative Costs: Administrative costs for all affected activities are estimated at $1.0 to $2.6 million ($2005) for consultation activities, meetings, etc. Forty two percent of administrative costs are anticipated to be devoted to grazing activities, while 22 percent are anticipated to be devoted to water-related issues.
    - Transportation: Transportation costs are estimated to be approximately $1 million for efforts to reduce impacts of road and bridge maintenance projects on spikedace and loach minnow.
    - Fire management: Two percent of the critical habitat area is potential wildland and urban interface area (910 acres). On these acres, the potential risk of catastrophic wildfire could increase, if fire management activities are delayed or altered due to spikedace and loach minnow conservation.
- **Stream Segment with Highest Impacts:** The stream segment with the greatest projected impacts is the Verde River stream segment, estimated at $11.7 to $64.9 million (undiscounted), $6.5 to $46.9 million (discounted at seven percent) or $8.9 to $55.3 million (discounted at three percent). Most of these costs occur in the lower portion of the Verde River. Quantified costs on this stream reach primarily stems from potential impacts to agriculture, but also includes impacts on development activities and recreation activities. Unquantified potential impacts could include impacts to other water users, including Verde Valley municipalities and the City of Prescott.

diversions of water (including groundwater use) reduce stream flow or modify hydrologic conditions to a degree that adversely impacts spikedace and loach minnow or their habitat. In addition, existing hydrologic models are not available to assess the role of any specific groundwater pumping activity or surface water diversion in determining stream flow or other hydrologic conditions within critical habitat. As such, this analysis does not quantify the probability or extent to which water use would need to be curtailed or modified to remedy impacts on the spikedace and loach minnow or their habitat. It does, however, provide information on the potential scale of the economic impacts that could occur if requirements associated with spikedace and loach minnow conservation result in changes in water diversions or conveyance.

BACKGROUND

4. Section 4(b)(2) of the Endangered Species Act (Act) requires the Service to designate critical habitat on the basis of the best scientific data available, after taking into consideration the economic impact, and any other relevant impact, of specifying any particular area as critical habitat. The Service may exclude areas from critical habitat designation when the benefits of exclusion outweigh the benefits of including the areas within critical habitat, provided the exclusion will not result in extinction of the species.[3] In addition, this analysis provides information to allow 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).[4] This report also complies with direction from the U.S. 10th Circuit Court of Appeals that, when deciding which areas to designate as critical habitat, the economic analysis informing that decision should include "co-extensive" effects.[5]

5. Executive Order 12866 directs Federal agencies to evaluate regulatory alternatives.[6] The Service identifies 25 stream segments for designation as critical habitat. One alternative to the proposed rule would be to designate all 25 stream segments, while a second alternative might be to designate only some of those stream segments. Potential impacts for each proposed stream segment are estimated in this report. In addition, as discussed in the previous paragraph, section 4(b)(2) of the Act allows the Service to exclude additional areas proposed for designation based on economic impact and other relevant

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[3] 16 U.S.C. §1533(b)(2).

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

[5] 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 critical habitat designation, regardless of whether those impacts are attributable co-extensively to other causes (*New Mexico Cattle Growers Ass'n v. U.S.F.W.S.*, 248 F.3d 1277 (10th Cir. 2001)).

[6] Executive Order 12866, "Regulatory Planning and Review," September 30, 1993; Executive Order 13211, "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use," May 18, 2001.

impacts. As a result, the impacts of multiple combinations of essential habitat are also available to the Service.

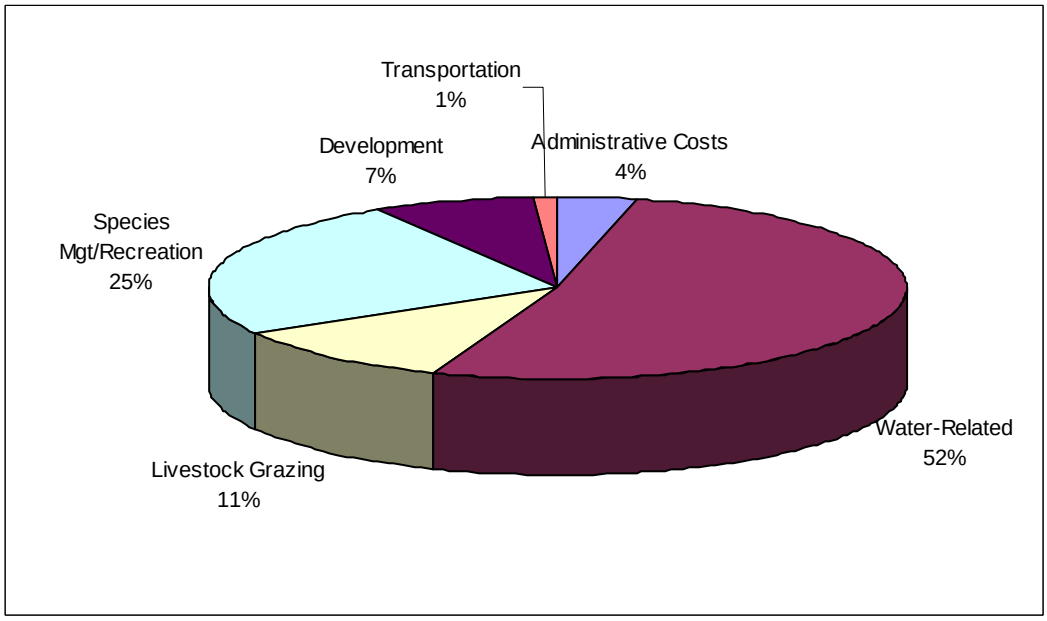
6. To comply with the 10th Circuit's direction to include all co-extensive effects, this analysis considers the potential economic impacts of efforts to protect the spikedace and loach minnow and their habitat (hereinafter referred to collectively as "spikedace and loach minnow conservation activities") in potential critical habitat. It does so 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. Actions undertaken to meet the requirements of other Federal, State, and local laws and policies may afford protection to the spikedace and loach minnow and their habitat, and thus contribute to the efficacy of critical habitat-related conservation and recovery efforts. Thus, the impacts of these activities are relevant for understanding the full impact of the proposed designation.

7. This analysis considers both economic efficiency and distributional effects. In the case of habitat conservation, efficiency effects generally reflect the opportunity costs associated with the commitment of resources to comply with habitat protection measures (e.g., lost economic opportunities associated with restrictions on land use). This analysis also addresses how potential economic impacts are likely to be distributed (distributional effects), including the potential effects of conservation activities on small entities and the energy industry. This information can be used by decision-makers to assess whether the effects of the designation might unduly burden a particular group or economic sector. Also, this analysis looks retrospectively at costs incurred since the date the species was listed and considers those costs that may occur after the designation is finalized.

RESULTS OF THE ANALYSIS

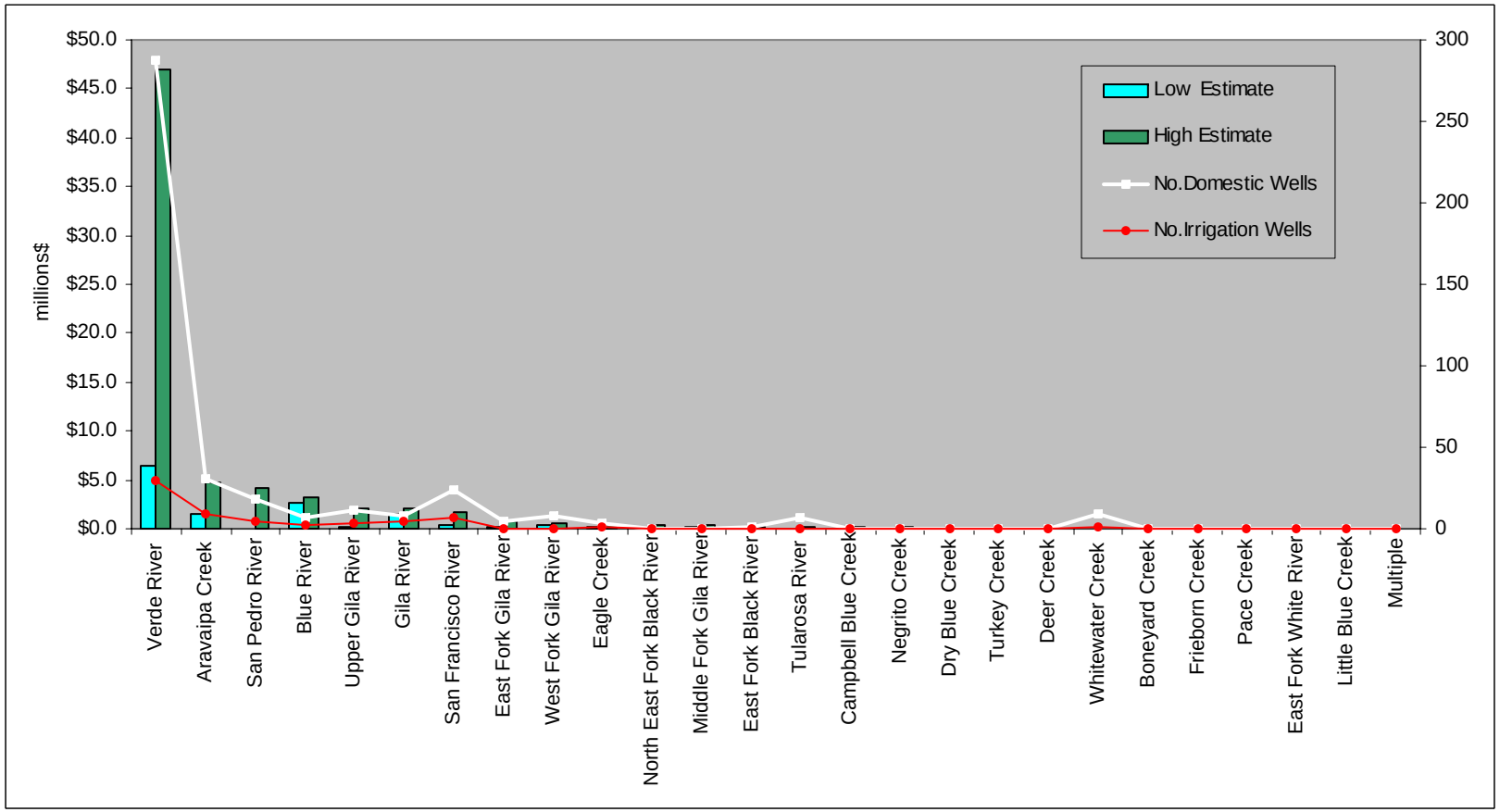
8. The potential economic impacts of spikedace and loach minnow proposed CHD stem from the current and proposed land uses in these areas. Many segments are relatively small streams located in rural areas with small resident human populations and agrarian economies. There is one exception to this pattern: the lower section of the proposed Verde River segment (Lower Verde) runs through several communities in the Verde Valley that are experiencing rapid growth. On this and other river segments, the primary non-Federal entities that could be affected by spikedace and loach minnow conservation efforts consist of water users (including municipal, agricultural, Tribal, and industrial water users) and livestock producers (primarily ranchers with Federal grazing permits). Exhibit ES-1 presents total future costs over 20 years by activity, discounted at seven percent. Results using a discount rate of three percent or undiscounted costs do not yield a significantly different relative distribution of costs.

EXHIBIT ES-1. FUTURE QUANTIFIED ECONOMIC IMPACTS BY AFFECTED ACTIVITY (TOTAL PRESENT VALUE ASSUMING A SEVEN-PERCENT DISCOUNT RATE), 2006-2025



9. Exhibit ES-2 presents forecast costs by stream reach anticipated over the next 20 years, assuming a discount rate of seven percent. The relative rankings of these units, by cost, do not change significantly when future costs are discounted at three percent or when undiscounted costs are considered. Note that these rankings do not include potential impacts to water users that could result from reductions in water availability, with the exception of agricultural impacts (e.g., domestic, mining, Tribal water uses). The text that follows describes these estimated future costs in more detail, and presents costs assuming a seven percent discount rate throughout the discussion (Appendix D presents total costs by stream reach in terms of undiscounted dollars, as well as in present value terms using a three percent discount rate). Exhibits ES-3 through ES-5 present a matrix of total future costs by activity. ES-6 identifies additional potential impacts that could not be quantified. ES-7 summarizes potential impacts associated with areas proposed for exclusion from CHD.

EXHIBIT ES-2. FUTURE ECONOMIC IMPACTS BY RIVER SEGMENT, 2006-2025 (TOTAL PRESENT VALUE IMPACTS ASSUMING A SEVEN-PERCENT DISCOUNT RATE)



Note that costs estimates do not include potential impacts for which the likelihood is unknown, including potential impacts to water users that could result from reductions in water availability. The number of domestic/municipal wells and irrigation wells is shown here as an indicator of the scale of potential impacts to these entities. Not shown are impacts to Tribal entities and mining interests. Impacts are presented over 20 years (2006-2025), assuming a discount rate of seven percent. Appendix D presents costs in terms of undiscounted dollars, as well as in present value terms using a three percent discount rate.

10. **WATER USE/MANAGEMENT:** Undiscounted costs on water users resulting from spikedace and loach minnow conservation activities are estimated to be $0.3 to $39 million over 20 years. Future impacts are estimated at $0.2 to $36.1 million ($0.02 to $3.4 million annually), using a discount rate of seven percent, or $0.2 to $37.6 million ($0.02 to $2.5 million annually), using a discount rate of three percent. In addition to these impacts, impacts on water users are possible if less water is made available for human use to accommodate the spikedace and loach minnow. However, as stated above, there are currently no data that indicate whether existing or future diversions of water (including groundwater use) reduce stream flow or modify hydrologic conditions to a degree that adversely impacts the spikedace and loach minnow or their habitat. Thus, the analysis provides information on the potential scale of the economic impacts that could occur if requirements associated with spikedace and loach minnow conservation result in changes in water diversions or conveyance.

11. Specifically, irrigated agriculture may adversely affect spikedace and loach minnow proposed CHD areas by affecting water quality, altering habitat and reducing water availability. As with other water use activities, agricultural irrigation activity has generally not been affected by spikedace and loach minnow conservation activities since the listing of the two species in 1986 (i.e., past project modifications to agricultural activities have not occurred other than consultations on diversion repair).

12. However, it is possible that irrigation activities could be affected if farmers make efforts to maintain adequate water quantity and flow for the species in the future. Because agricultural water use comprises 98 percent of surface water use and 81 percent of groundwater use in counties that contain critical habitat, it appears most likely that, if additional water supplies are needed for these species, they would come from current agricultural water use. Thus, the analysis assumes that to accommodate spikedace and loach minnow, farmers may give up water and cease to farm, resulting in losses of agricultural land value.

13. Should irrigated agriculture be curtailed to accommodate spikedace and loach minnow, approximately 6,310 acres located within and in the vicinity of proposed CHD that are currently irrigated for cropland agriculture could be retired from production (three percent of total irrigated lands in affected counties). These 6,310 acres include 830 acres located within proposed CHD. The irrigated crop production at risk of being lost is valued at approximately $4.5 million ($2005) within proposed CHD areas, or approximately $38.5 million ($2005) including lands that rely on water diverted from proposed CHD. Thus, the total cropland value potentially foregone ($38.5 million in $2005) is included in high end estimates of impacts on water use.[7]

14. Additional concerns include municipal groundwater use by the communities of the Verde Valley and the City of Prescott. Most communities in proposed CHD areas are dependent on groundwater supplies: 63 percent of groundwater wells in this proposed CHD fall in

[7] The value added of cropland is estimated as the difference in land value between irrigated farmland (i.e. cropland) and non-irrigated farmland (i.e. pasture), using USDA estimates of cropland value and pasturelands.

the Verde River unit. To supply the City with additional water for domestic use, the City of Prescott recently purchased a ranch with water rights in the vicinity of the Verde River headwaters. Tribal and mining water issues are discussed below.

15. **MINING:** A considerable amount of Arizona's mining activity takes place in counties that contain proposed critical habitat for the spikedace and loach minnow. While few active mineral mining activities occur within proposed CHD areas, at least five mine facilities located near the proposed CHD could be affected if they are required to modify their water use to avoid adverse impacts on the spikedace and loach minnow. Because the hydrologic connection between mining activities and spikedace and loach minnow CHD is not well understood, impacts on mining activities are not quantified (see Section 5).[8]

16. **TRIBAL LANDS:** The Proposed Rule includes lands of the Yavapai-Apache Nation, San Carlos Apache, and White Mountain Apache Tribes. As noted previously, the reservation lands of the White Mountain Apache and San Carlos Apache are proposed for exclusion from CHD. The Tribes are concerned that critical habitat on their lands will have a disproportionate impact on their ability to use resources on their sovereign lands and to successfully achieve economic self-sufficiency. The absence of some cost information related to the potential impacts of spikedace and loach minnow conservation on Tribal lands results in a probable underestimate of future costs to Tribal entities in this analysis.

17. **SPECIES MANAGEMENT AND RECREATION:** Future species and habitat management may include re-establishment of spikedace and loach minnow, constructing fish barriers, and surveying and monitoring. Several of these future species management actions were already in progress prior to the proposal of CHD. In fact, future costs associated with species conservation activities in proposed CHD areas are expected to largely be borne by USBR as part of mitigation associated with a past consultation on the Central Arizona Project (CAP). Undiscounted species management costs are estimated to $14.7 to $14.9 million over 20 years, or approximately $8.4 to $8.5 million (discounted at seven percent), and $11.2 to $11.5 million (discounted at three percent). Costs include installation of nonnative fish barriers, as well as an extensive program for monitoring and removal of nonnative fish.

18. Areas currently stocked with non-native rainbow trout include the Lower Verde segment (Camp Verde area) of the Verde River reach in Complex 1 and East Fork Gila River in Complex 5.[9] It should be noted that the Lower Verde segment is also designated as critical habitat for the razorback sucker. Thus, species management actions undertaken on this reach will benefit both spikedace and razorback sucker. The future impact of proposed CHD on the stocking regimes in these reaches is unknown, as is the reduction in

[8] Costs associated with maintenance of water diversions and other water-related facilities are included in water management costs.

[9] Most of the proposed Verde River segment is not managed for sportfish. The Lower Verde Area, which includes the town of Camp Verde, is stocked with trout. Stocked trout generates 13,000 angler days annually for the entire Cottonwood (Lower Verde) area. At $61.55 per angler day, the value of these angler days is estimated to be $800,150 annually. The Upper Verde supports only 191 annual angler days of non-trout fishing.

fishing activity that would occur if stocking is curtailed. Further, it is unknown whether non-native trout may be replaced with stocked native fish (e.g. Apache trout). Thus, this analysis estimates the value of angler days at risk if sportfish stocking were discontinued on these reaches as part of the high end estimates. Lost angler days are valued at $0 to $16.3 million in undiscounted dollars, $0 to $8.6 million (discounted at seven percent), or $0 to $12.1 million (discounted at three percent). It should be noted that because State fish managers typically identify alternative sites for stocked fish when areas are closed to stocking, these angler days are likely to be redistributed to other areas rather than lost altogether. The proposed CHD areas where off-highway vehicle (OHV) use is most prevalent are within Apache-Sitgreaves National Forest, which contains several reaches in proposed CHD in Complex 2 and 4.[10] However, no past closures have been documented associated with past CHDs for these species. Thus, this analysis does not attempt to quantify future impacts of spikedace and loach minnow conservation on OHV use.

19. **LIVESTOCK GRAZING:** Future impacts are anticipated to primarily include costs associated with riparian fence construction and maintenance. For stream reaches where riparian fencing is known to exist currently, this analysis attributes the costs of future fence maintenance to spikedace and loach minnow conservation. The Service points out that in some cases, alternative management scenarios, such as seasonal rest combined with grazing rotation, can serve to reduce impacts to these species and reduce the need for additional riparian fencing. The Service also notes that in some cases areas may not require fencing due to topographic features that prevent stream access by livestock.[11] As a result, costs may be overestimated for some reaches. Over 20 years, undiscounted costs related to grazing conservation activities are estimated to range from $0.7 to $14.3 million. Future costs are estimated to range from $0.3 million to $7.4 million ($0.03 to $0.70 million annually), using a discount rate of seven percent, or $0.4 to $10.4 million ($0.03 to $0.7 million annually), using a discount rate of three percent. Approximately 76 ranches, or 4.7 percent of ranches in counties that contain proposed CHD, could be impacted by conservation activities, assuming that one ranch is responsible for each affected allotment. Annual ranch level impacts are estimated to range from $390 to $9,200 per year (assuming a seven percent discount rate). However, it is likely that a portion of these costs will be borne by land management agencies. Future grazing impacts are anticipated to be highest in the Verde River and Upper Gila River segments.

20. Reductions in grazing effort on Federal lands (i.e., reduced permitted or authorized animal-unit months) are included in past cost estimates for these species because grazing has been excluded from the riparian corridor in most CHD reaches, in part due to native

[10] Proposed CHD reaches that cross Apache-Sitgreaves include: Blue River, Boneyard Creek, Campbell Blue Creek, East Fork Black River, Eagle Creek, Little Blue Creek, North East Fork Black River, San Francisco River.

[11] In public comments, private ranchers have suggested that current management has been successful at mitigating the negative effects of grazing on spikedace and loach minnow habitat.

fish concerns. These costs are estimated to be between $0.5 and $3.9 million and are presented in Chapter 4 of this report.[12]

21. **RESIDENTIAL AND COMMERCIAL DEVELOPMENT:** The most likely location for development activities in spikedace and loach minnow critical habitat is along the Lower Verde section of the Verde River segment, which contains a large amount of private land, large current human population, and high projected population growth potential in the next 20 years. Of 1,190 parcels that intersect proposed CHD on the Verde segment, almost half (49 percent) currently contain at least one structure. Future development projections on parcels within proposed CHD are not available. Given high growth projections, this analysis assumes that proposed CHD areas will be built out to their maximum zoning potential within the next 20 years. Six hundred and seven structures already occur on parcels that fall in proposed CHD and 1,646 additional structures are estimated to be allowable by zoning. Future costs to developments on the Verde River segment associated with spikedace and loach minnow conservation over the next 20 years are estimated to range from $6.4 to $9.8 million (undiscounted), $3.4 million to $5.2 million (discounted at seven percent), or $4.8 to $7.3 million (discounted at three percent). These costs include: fencing, survey and monitoring, and off-site mitigation.

22. **TRANSPORTATION:** Projects in the proposed CHD may cause sedimentation problems. Approximately 21 major roads and low-water crossings traverse the proposed CHD 23 times. The future costs of spikedace and loach minnow conservation measures for transportation projects are expected to be $1.3 to $1.4 undiscounted over 20 years, $0.66 to $0.74 million (discounted at seven percent), or $0.9 to $1.0 million (discounted at three percent) associated with road and bridge maintenance projects.

23. **FIRE MANAGEMENT:** Fire management activities are most likely to be affected by spikedace and loach minnow conservation activities where Wildland-Urban Interface (WUI) areas overlap with the proposed CHD. This overlap occurs on 910 acres, or approximately two percent of proposed CHD. The overlap may pose some increased risk of fire to those and nearby areas.

24. Expected economic impacts on fire management activities include administrative costs related to consultation on fire management plans, as well as the costs of evacuation and reestablishment of spikedace and loach minnow populations in the event of a wildfire. The total costs of spikedace and loach minnow evacuation and reestablishment in the event of a wildfire are estimated to be approximately $42,000 to $45,000 per effort. Due to the difficulty in predicting the locations of future catastrophic wildfires, this analysis does not assign spikedace and loach minnow evacuation and reestablishment costs to stream reaches within the proposed CHD.

[12] As noted above, the Service notes that the exclusion of grazing from riparian areas does not always result in a reduction in herd size; rather, other waters may be developed, while herd size remains the same. Service comment received Mar. 15, 2006.

EXHIBIT ES-3. SUMMARY OF FUTURE IMPACTS BY RIVER SEGMENT AND ACTIVITY IN PROPOSED CHD ($MILLIONS), 2006-2025 (UNDISCOUNTED DOLLARS)

	WATER-RELATED		GRAZING		DEVELOPMENT		SPECIES MGT & RECREATION		TRANSPORTATION		ADMINISTRATIVE		TOTAL	
RIVER SEGMENT	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH
Verde River	$0.12	$30.42	$0.13	$3.13	$6.38	$9.77	$4.04	$20.04	$0.75	$0.75	$0.31	$0.77	**$11.73**	**$64.89**
Boneyard Creek	$0	$0	$0	$0.08	$0	$0	$0	$0	$0	$0	$0	$0	**$0**	**$0.08**
East Fork Black River	$0	$0	$0.01	$0.28	$0	$0	$0	$0	$0	$0	$0.08	$0.19	**$0.09**	**$0.48**
North East Fork Black River	$0	$0	$0.03	$0.58	$0	$0	$0	$0	$0	$0	$0.08	$0.19	**$0.10**	**$0.77**
East Fork White River	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**	**$0**
Aravaipa Creek	$0.02	$3.13	$0.03	$0.57	$0	$0	$2.54	$2.54	$0.25	$0.25	$0.08	$0.19	**$2.91**	**$6.69**
Deer Creek	$0	$0	$0.01	$0.15	$0	$0	$0	$0	$0	$0	$0	$0	**$0.01**	**$0.15**
Turkey Creek	$0	$0	$0.01	$0.14	$0	$0	$0	$0	$0	$0	$0	$0	**$0.01**	**$0.14**
Gila River	$0.04	$0.04	$0.06	$1.17	$0	$0	$2.70	$2.70	$0	$0	$0.08	$0.19	**$2.88**	**$4.11**
San Pedro River	$0	$4.46	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**	**$4.46**
Eagle Creek	$0.04	$0.04	$0.01	$0.24	$0	$0	$0	$0	$0	$0	$0.21	$0.51	**$0.26**	**$0.79**
San Francisco River	$0	$0.01	$0.12	$1.94	$0	$0	$0.09	$0.09	$0.25	$0.30	$0.33	$0.83	**$0.79**	**$3.17**
Tularosa River	$0	$0	$0.02	$0.39	$0	$0	$0.09	$0.09	$0	$0	$0	$0	**$0.10**	**$0.47**
Frieborn Creek	$0	$0	$0	$0.06	$0	$0	$0	$0	$0	$0	$0	$0	**$0**	**$0.06**
Negrito Creek	$0	$0	$0.01	$0.17	$0	$0	$0.09	$0.09	$0	$0	$0	$0	**$0.10**	**$0.26**
Whitewater Creek	$0	$0	$0	$0	$0	$0	$0.09	$0.09	$0	$0	$0	$0	**$0.09**	**$0.09**
Blue River	$0.08	$0.08	$0.01	$0.30	$0	$0	$4.04	$4.04	$0	$0.10	$0.44	$1.09	**$4.57**	**$5.61**
Campbell Blue Creek	$0	$0	$0.02	$0.35	$0	$0	$0	$0	$0	$0	$0.03	$0.06	**$0.04**	**$0.42**

RIVER SEGMENT	WATER-RELATED		GRAZING		DEVELOPMENT		SPECIES MGT & RECREATION		TRANSPORTATION		ADMINISTRATIVE		TOTAL	
	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH
Little Blue Creek	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**	**$0**
Dry Blue Creek	$0	$0	$0.01	$0.15	$0	$0	$0	$0	$0	$0	$0	$0	**$0.01**	**$0.15**
Pace Creek	$0	$0	$0	$0.04	$0	$0	$0	$0	$0	$0	$0	$0	**$0**	**$0.04**
East Fork Gila River	$0	$0	$0.05	$1.08	$0	$0	$0.15	$0.47	$0	$0	$0	$0	**$0.19**	**$1.55**
Upper Gila River	$0	$0.59	$0.13	$2.97	$0	$0	$0.09	$0.09	$0	$0	$0	$0	**$0.21**	**$3.64**
Middle Fork Gila River	$0	$0	$0.02	$0.41	$0	$0	$0.15	$0.15	$0	$0	$0	$0	**$0.17**	**$0.55**
West Fork Gila River	$0	$0.01	$0	$0.04	$0	$0	$0.65	$0.90	$0	$0	$0	$0	**$0.65**	**$0.95**
Multiple[2]	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0.33	$0.83	**$0.33**	**$0.83**
Total	**$0.30**	**$38.79**	**$0.65**	**$14.23**	**$6.38**	**$9.77**	**$14.70**	**$31.28**	**$1.26**	**$1.40**	**$1.95**	**$4.87**	**$25.24**	**$100.34**

Notes:
[1] Impacts are presented over 20 years (2006-2025) in undiscounted dollars.
[2] Costs in the "Multiple" category are comprised of administrative costs from consultations that deal with multiple stream reaches and complexes.

EXHIBIT ES-4. SUMMARY OF FUTURE IMPACTS BY RIVER SEGMENT AND ACTIVITY IN PROPOSED CHD ($MILLIONS), 2006-2025 (DISCOUNTED AT 7 PERCENT)

	WATER-RELATED		GRAZING		DEVELOPMENT		SPECIES MGT & RECREATION		TRANSPORTATION		ADMINISTRATIVE		TOTAL	
RIVER SEGMENT	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH
Verde River	$0.06	$28.38	$0.07	$1.66	$3.38	$5.18	$2.40	$10.88	$0.40	$0.40	$0.16	$0.41	**$6.47**	**$46.90**
Boneyard Creek	$0	$0	$0	$0.04	$0	$0	$0	$0	$0	$0	$0	$0	**$0**	**$0.04**
East Fork Black River	$0	$0	$0.01	$0.15	$0	$0	$0	$0	$0	$0	$0.04	$0.10	**$0.05**	**$0.25**
North East Fork Black River	$0	$0	$0.01	$0.31	$0	$0	$0	$0	$0	$0	$0.04	$0.10	**$0.05**	**$0.41**
East Fork White River	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**	**$0**
Aravaipa Creek	$0.01	$2.92	$0.01	$0.30	$0	$0	$1.35	$1.35	$0.13	$0.13	$0.04	$0.10	**$1.54**	**$4.80**
Deer Creek	$0	$0	$0	$0.06	$0	$0	$0	$0	$0	$0	$0	$0	**$0**	**$0.06**
Turkey Creek	$0	$0	$0	$0.07	$0	$0	$0	$0	$0	$0	$0	$0	**$0**	**$0.07**
Gila River	$0.02	$0.02	$0.02	$0.53	$0	$0	$1.43	$1.43	$0	$0	$0.04	$0.10	**$1.51**	**$2.08**
San Pedro River	$0	$4.17	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**	**$4.17**
Eagle Creek	$0.02	$0.02	$0.01	$0.13	$0	$0	$0	$0	$0	$0	$0.11	$0.27	**$0.14**	**$0.42**
San Francisco River	$0	$0.01	$0.04	$1.01	$0	$0	$0.05	$0.05	$0.13	$0.16	$0.18	$0.44	**$0.40**	**$1.66**
Tularosa River	$0	$0	$0.01	$0.20	$0	$0	$0.05	$0.05	$0	$0	$0	$0	**$0.06**	**$0.25**
Frieborn Creek	$0	$0	$0	$0.03	$0	$0	$0	$0	$0	$0	$0	$0	**$0**	**$0.03**
Negrito Creek	$0	$0	$0	$0.09	$0	$0	$0.05	$0.05	$0	$0	$0	$0	**$0.05**	**$0.14**
Whitewater Creek	$0	$0	$0	$0	$0	$0	$0.05	$0.05	$0	$0	$0	$0	**$0.05**	**$0.05**
Blue River	$0.04	$0.04	$0.01	$0.16	$0	$0	$2.40	$2.40	$0	$0.05	$0.23	$0.58	**$2.68**	**$3.23**
Campbell Blue Creek	$0	$0	$0.01	$0.19	$0	$0	$0	$0	$0	$0	$0.01	$0.03	**$0.02**	**$0.22**

	WATER-RELATED		GRAZING		DEVELOPMENT		SPECIES MGT & RECREATION		TRANSPORTATION		ADMINISTRATIVE		TOTAL	
RIVER SEGMENT	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH
Little Blue Creek	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**	**$0**
Dry Blue Creek	$0	$0	$0	$0.08	$0	$0	$0	$0	$0	$0	$0	$0	**$0**	**$0.08**
Pace Creek	$0	$0	$0	$0.02	$0	$0	$0	$0	$0	$0	$0	$0	**$0**	**$0.02**
East Fork Gila River	$0	$0	$0.02	$0.57	$0	$0	$0.10	$0.27	$0	$0	$0	$0	**$0.12**	**$0.84**
Upper Gila River	$0	$0.55	$0.07	$1.57	$0	$0	$0.05	$0.05	$0	$0	$0	$0	**$0.11**	**$2.17**
Middle Fork Gila River	$0	$0	$0.01	$0.22	$0	$0	$0.10	$0.10	$0	$0	$0	$0	**$0.11**	**$0.31**
West Fork Gila River	$0	$0.01	$0	$0.02	$0	$0	$0.36	$0.52	$0	$0	$0	$0	**$0.37**	**$0.55**
Multiple[2]	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0.18	$0.44	**$0.18**	**$0.44**
Total	**$0.16**	**$36.12**	**$0.31**	**$7.40**	**$3.38**	**$5.18**	**$8.36**	**$17.17**	**$0.66**	**$0.74**	**$1.03**	**$2.58**	**$13.91**	**$69.19**
Annualized (7%)	**$0.02**	**$3.41**	**$0.03**	**$0.70**	**$0.32**	**$0.49**	**$0.79**	**$1.62**	**$0.06**	**$0.07**	**$0.18**	**$0.46**	**$1.40**	**$6.75**

Notes:

[1] Impacts are presented over 20 years (2006-2025), assuming a discount rate of seven percent. Cost estimates presented here represent the upper-bound costs calculated in this the analysis. Appendix D presents costs in terms of undiscounted dollars, as well as in present value terms, using a three percent discount rate.

[2] Costs in the "Multiple" category are comprised of administrative costs from consultations that deal with multiple stream reaches and complexes.

EXHIBIT ES-5 SUMMARY OF FUTURE IMPACTS BY RIVER SEGMENT AND ACTIVITY IN PROPOSED CHD ($MILLIONS), 2006-2025 (DISCOUNTED AT 3 PERCENT)

	WATER-RELATED		GRAZING		DEVELOPMENT		SPECIES MGT & RECREATION		TRANSPORTATION		ADMINISTRATIVE		TOTAL	
RIVER SEGMENT	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH
Verde River	$0.09	$29.51	$0.10	$2.33	$4.75	$7.27	$3.17	$15.07	$0.56	$0.56	$0.23	$0.57	**$8.89**	**$55.31**
Boneyard Creek	$0	$0	$0	$0.06	$0	$0	$0	$0	$0	$0	$0	$0	**$0**	**$0.06**
East Fork Black River	$0	$0	$0.01	$0.21	$0	$0	$0	$0	$0	$0	$0.06	$0.14	**$0.07**	**$0.35**
North East Fork Black River	$0	$0	$0.02	$0.43	$0	$0	$0	$0	$0	$0	$0.06	$0.14	**$0.08**	**$0.58**
East Fork White River	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**	**$0**
Aravaipa Creek	$0.02	$3.04	$0.02	$0.42	$0	$0	$1.89	$1.89	$0.19	$0.19	$0.06	$0.14	**$2.17**	**$5.68**
Deer Creek	$0	$0	$0	$0.09	$0	$0	$0	$0	$0	$0	$0	$0	**$0**	**$0.09**
Turkey Creek	$0	$0	$0	$0.10	$0	$0	$0	$0	$0	$0	$0	$0	**$0**	**$0.10**
Gila River	$0.03	$0.03	$0.03	$0.74	$0	$0	$2.01	$2.01	$0	$0	$0.06	$0.14	**$2.13**	**$2.92**
San Pedro River	$0	$4.33	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**	**$4.33**
Eagle Creek	$0.03	$0.03	$0.01	$0.18	$0	$0	$0	$0	$0	$0	$0.15	$0.38	**$0.19**	**$0.59**
San Francisco River	$0	$0.01	$0.06	$1.42	$0	$0	$0.07	$0.07	$0.19	$0.22	$0.25	$0.62	**$0.56**	**$2.33**
Tularosa River	$0	$0	$0.01	$0.29	$0	$0	$0.07	$0.07	$0	$0	$0	$0	**$0.08**	**$0.35**
Frieborn Creek	$0	$0	$0	$0.04	$0	$0	$0	$0	$0	$0	$0	$0	**$0**	**$0.04**
Negrito Creek	$0	$0	$0.01	$0.13	$0	$0	$0.07	$0.07	$0	$0	$0	$0	**$0.07**	**$0.19**
Whitewater Creek	$0	$0	$0	$0	$0	$0	$0.07	$0.07	$0	$0	$0	$0	**$0.07**	**$0.07**
Blue River	$0.06	$0.06	$0.01	$0.22	$0	$0	$3.17	$3.17	$0	$0.07	$0.32	$0.81	**$3.56**	**$4.34**
Campbell Blue Creek	$0	$0	$0.01	$0.26	$0	$0	$0	$0	$0	$0	$0.02	$0.05	**$0.03**	**$0.31**
Little Blue Creek	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**	**$0**

RIVER SEGMENT	WATER-RELATED		GRAZING		DEVELOPMENT		SPECIES MGT & RECREATION		TRANSPORTATION		ADMINISTRATIVE		TOTAL	
	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH
Dry Blue Creek	$0	$0	$0.01	$0.11	$0	$0	$0	$0	$0	$0	$0	$0	**$0.01**	**$0.11**
Pace Creek	$0	$0	$0	$0.03	$0	$0	$0	$0	$0	$0	$0	$0	**$0**	**$0.03**
East Fork Gila River	$0	$0	$0.03	$0.80	$0	$0	$0.12	$0.36	$0	$0	$0	$0	**$0.16**	**$1.16**
Upper Gila River	$0	$0.57	$0.09	$2.21	$0	$0	$0.07	$0.07	$0	$0	$0	$0	**$0.16**	**$2.84**
Middle Fork Gila River	$0	$0	$0.01	$0.30	$0	$0	$0.12	$0.12	$0	$0	$0	$0	**$0.13**	**$0.42**
West Fork Gila River	$0	$0.01	$0	$0.03	$0	$0	$0.43	$0.70	$0	$0	$0	$0	**$0.43**	**$0.74**
Multiple[2]	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0.25	$0.62	**$0.25**	**$0.62**
Total	**$0.23**	**$37.58**	**$0.44**	**$10.40**	**$4.75**	**$7.27**	**$11.23**	**$23.64**	**$0.93**	**$1.04**	**$1.45**	**$3.62**	**$19.02**	**$83.56**
Annualized (3%)	**$0.02**	**$2.53**	**$0.03**	**$0.70**	**$0.32**	**$0.49**	**$0.76**	**$1.59**	**$0.06**	**$0.07**	**$0.13**	**$0.33**	**$1.31**	**$5.70**

Notes:
[1] Impacts are presented over 20 years (2006-2025), assuming a discount rate of three percent.

[2] Costs in the "Multiple" category are comprised of administrative costs from consultations that deal with multiple stream reaches and complexes.

EXHIBIT ES-6. SUMMARY OF FUTURE NON-QUANTIFIED IMPACTS BY RIVER SEGMENT AND ACTIVITY IN PROPOSED CHD, 2006-2025

	WATER USERS		MINING	TRIBES	FIRE MGT
RIVER SEGMENT	DOMESTIC GW WELLS IN CHD [1]	IRRIGATION WELLS IN CHD [2]	NAME OF FACILITY [2]	NAME OF TRIBE [3]	ACRES [4]
Verde River	287	30	None	Yavapai-Apache	475
Boneyard Creek	-	0	None	n/a	0
East Fork Black River	1	0	None	n/a	19
North East Fork Black River	-	0	None	n/a	0
East Fork White River	-	0	None	White Mountain Apache	0
Aravaipa Creek	31	9	None	n/a	0
Deer Creek	-	0	None	n/a	0
Turkey Creek	-	0	None	n/a	0
Gila River	8	5	Ray/Hayden	San Carlos Apache	0
San Pedro River	18	4	Ray/Hayden	n/a	169
Eagle Creek	3	1	Morenci	San Carlos Apache	0
San Francisco River	24	7	None	n/a	182
Tularosa River	7	0	None	n/a	0
Frieborn Creek	-	0	None	n/a	0
Negrito Creek	-	0	None	n/a	0
Whitewater Creek	9	1	None	n/a	0
Blue River	7	2	None	n/a	0
Campbell Blue Creek	-	0	None	n/a	0
Little Blue Creek	-	0	None	n/a	0
Dry Blue Creek	-	0	None	n/a	0
Pace Creek	-	0	None	n/a	0
East Fork Gila River	4	0	None	n/a	0
Upper Gila River	11	3	Tyrone	n/a	65
Middle Fork Gila River	-	0	None	n/a	0
West Fork Gila River	8	0	None	n/a	0
Total	**418**	**62**	**See Sec 5**	**See Sec 8**	**910**

Notes:

[1] The number of domestic wells is presented as an indicator of the pressure by domestic users on water supplies in proposed CHD.

[2] The name of mining facilities that rely on water resources in proposed CHD are included here. A detailed discussion of these resources in included in Chapter 5 of this report.

[3] The Tribes with lands in proposed CHD are included here. A detailed discussion of potential impacts to Tribes is included in Chapter 8 of this report. The reservation lands of the White Mountain Apache and San Carlos Apache are proposed for exclusion from CHD.

[4] The number of wildland and urban interface acres (WUI) are presented as an indicator of areas where fire management efforts are most likely to be undertaken.

EXHIBIT ES-7. AREAS PROPOSED FOR EXCLUSION

COMPLEX	RIVER SEGMENT	PERCENT OF REACH PROPOSED FOR EXCLUSION (STREAM MILES)	REASON FOR EXCLUSION	POTENTIAL IMPACTS
2	East Fork White River	100% (12.5)	Lands of the White Mountain Apache	Impacts on Tribal rights and Trust resources, including exercise of water rights, timber, and fisheries. Impacts on economic activity, the recreation program, cultural practices, municipal water supply, and administrative costs
4	Eagle Creek	38% (17.2)	Lands of the San Carlos Apache	Impacts on Tribal rights and Trust resources, water use impacts, livestock grazing impacts, fire management impacts, and administrative costs.

CHAPTER 1 | FRAMEWORK FOR ANALYSIS

25. The purpose of this report is to estimate the economic impact of actions taken to protect the federally listed *Meda fulgida* (spikedace) and *Tiaroga cobitis* (loach minnow) and their habitat. It attempts to quantify the economic effects associated with the proposed designation of critical habitat. It does so 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. The analysis looks retrospectively at costs incurred since the spikedace and loach minnow were listed, and it attempts to predict future costs likely to occur after the proposed CHD is finalized.

26. This information is intended to assist the Secretary in determining whether the benefits of excluding particular areas from the designation outweigh the benefits of including those areas in the designation.[13] 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).[14] This report also complies with direction from the U.S. Court of Appeals for the 10th Circuit that "co-extensive" effects should be included in the economic analysis to inform decision-makers regarding which areas to designate as critical habitat.[15]

27. This section describes the framework for the analysis. First, it describes the general analytic approach to estimating economic effects, including a discussion of both efficiency and distributional effects. Next, this section discusses the scope of the analysis, including the link between existing and critical habitat-related protection efforts and economic impacts. Then, it presents the analytic time frame used in the report. Finally, this section lists the information sources relied upon in the analysis.

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[13] 16 U.S.C. '1533(b)(2).

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

[15] In 2001, the U.S. Court of Appeals for the 10th Circuit 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 v. U.S.F.W.S., 248 F.3d 1277 (10th Cir. 2001)).

1.1 APPROACH TO ESTIMATING ECONOMIC EFFECTS

28. This economic analysis considers both the economic efficiency and distributional effects that may result from activities to protect the spikedace and loach minnow and their habitat (hereinafter referred to collectively as "spikedace and loach minnow conservation activities"). Economic efficiency effects generally reflect "opportunity costs" associated with the commitment of resources required to accomplish species and habitat conservation. For example, if activities that can take place on a parcel of land 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 spikedace and loach minnow conservation activities.

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

1.1.1 EFFICIENCY EFFECTS

30. 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 understand how society, as a whole, will be affected by a regulatory action. In the context of regulations that protect spikedace and loach minnow habitat, these 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 surpluses in affected markets.[16]

31. In some instances, compliance costs may provide a reasonable approximation for the efficiency effects associated with a regulatory action. For example, a Federal land manager, such as the USFS, 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 the parcel not been included in the designation. When compliance activity is not expected to significantly

[16] 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., A Guide to Benefit-Cost Analysis (2nd Ed.), Prospect Heights, Illinois: Waveland Press, Inc., 1990; and U.S. Environmental Protection Agency, Guidelines for Preparing Economic Analyses, EPA 240-R-00-003, September 2000, available at http://yosemite.epa.gov/ee/epa/eed.nsf/ webpages/Guidelines.html.

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 can provide a reasonable estimate of the change in economic efficiency.

32. Where habitat protection measures are expected to significantly impact 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 market.

33. This analysis begins by measuring costs associated with measures taken to protect spikedace and loach minnow and their habitat. As noted above, in some cases, compliance costs can provide a reasonable estimate of changes in economic efficiency. However, if the cost of conservation activities is expected to significantly impact markets, the analysis will consider potential changes in consumer and/or producer surplus in affected markets.

1.1.2 DISTRIBUTIONAL AND REGIONAL ECONOMIC EFFECTS

34. Measurements of changes in economic efficiency focus on the net impact of conservation activities, without consideration of how certain economic sectors or groups of people are affected. Thus, a discussion of efficiency effects alone may miss important distributional considerations. OMB encourages Federal agencies to consider distributional effects separately from efficiency effects.[17] This analysis considers several types of distributional effects, including impacts on small entities; impacts on energy supply, distribution, and use; and regional economic impacts. It is important to note that these are fundamentally different measures of economic impact than efficiency effects, and thus cannot be added to or compared with estimates of changes in economic efficiency.

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

35. This analysis considers how small entities, including small businesses, organizations, and governments, as defined by the RFA, might be affected by future spikedace and loach minnow conservation activities.[18] In addition, in response to Executive Order 13211 "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use," this analysis considers the future impacts of conservation activities on the energy industry and its customers.[19]

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[17] 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.

[18] 5 U.S.C. ' 601 et seq.

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

Calculating Present Value and Annualized Impacts

For each land use activity, this analysis compares economic impacts incurred in different time periods in present value terms. The present value presents the value of a payment or stream of payments in common dollar terms. That is, it is the sum of a series of past or future cash flows expressed in today's dollars. Translation of economic impacts of past or future costs to present value terms requires the following: a) past or projected future costs of spikedace and loach minnow conservation activities; and b) the specific years in which these impacts have been or are expected to be incurred. With these data, the present value of the past or future stream of impacts (PV_c) of spikedace and loach minnow conservation activities from year t to T is measured in 2005 dollars according to the following standard formula:[a]

$$PV_c = \sum_{t=t_0}^{t=T} \frac{C_t}{(1+r)^{t-2005}}$$

C_t = cost of spikedace and loach minnow conservation activities in year t

r = discount rate[b]

Impacts of conservation activities for each activity in each unit are also expressed as annualized values. Annualized values are calculated to provide comparison of impacts across activities with varying forecast periods (T). For this analysis, however, all activities employ a forecast period of 20 years, 2006 through 2025. Annualized impacts of future spikedace and loach minnow conservation activities (APV_c) are calculated by the following standard formula:

$$APV_c = PV_c \left[\frac{r}{1-(1+r)^{-(N)}} \right]$$

N = number of years in the forecast period (in this analysis, 20 years)

[a] To derive the present value of past conservation activities for this analysis, t is 1986 and T is 2005; to derive the present value of future conservation activities, t is 2006 and T is 2025.

[b] To discount and annualize costs, guidance provided by the OMB specifies the use of a real rate of seven percent. In addition, OMB recommends sensitivity analysis using other discount rates such as three percent, which some economists believe better reflects the social rate of time preference. (U.S. Office of Management and Budget, Circular A-4, September 17, 2003 and U.S. Office of Management and Budget, "Draft 2003 Report to Congress on the Costs and Benefits of Federal Regulations; Notice," 68 *Federal Register* 5492, February 3, 2003.)

Regional Economic Effects

36. 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. 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.

37. The use of regional input/output models in an analysis of the impacts of species and habitat conservation activities 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.

38. 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

39. 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 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 coextensive with the designation.[20,21]

[20] In 2001, the U.S. Court of Appeals for the 10th Circuit 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 Assn v. U.S.F.W.S., 248 F.3d 1277 (10th Cir. 2001)).

40. Coextensive 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. 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 activities affording protection to a listed species likely contribute to the efficacy of the CHD activities, 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.

1.2.1 SECTIONS OF THE ACT RELEVANT TO THE ANALYSIS

41. This analysis focuses on activities that are influenced by the Service through sections 4, 7, 9, and 10 of the Act. Section 4 of the Act focuses on the listing and recovery of endangered and threatened species, as well as the CHD. In this section, the Secretary is required to list species as endangered or threatened "solely on the basis of the best available scientific and commercial data."[22] Section 4 also requires the Secretary to designate critical habitat "on the basis of the best scientific data available and after taking into consideration the economic impact, and any other relevant impact, of specifying any particular area as critical habitat."[23]

42. The protections afforded to threatened and endangered species and their habitat are described in sections 7, 9, and 10 of the Act, and economic impacts resulting from these protections are the focus of this analysis:

- Section 7 of the Act requires Federal agencies to consult with the Service to ensure that any action authorized, funded, or carried out will not likely jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of 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 CHD.[24]
- Section 9 defines the actions that are prohibited by the Act. In particular, it prohibits the "take" of endangered wildlife, where "take" means to "harass, harm,

[21] In 2004, the U.S. Ninth 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.

[22] 16 U.S.C. 1533.

[23] 16 U.S.C. 1533.

[24] 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.

pursue, or collect, or to attempt to engage in any such conduct."[25] The economic impacts associated with this section manifest themselves in sections 7 and 10.

- 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 an endangered animal species in order to meet the conditions for issuance of an incidental take permit in connection with the development and management of a property.[26] 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.

43. The designation of critical habitat does not require completion of an HCP; however, the designation may influence conservation measures provided under HCPs.

1.2.2 OTHER RELEVANT PROTECTION EFFORTS

44. 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.[27] For the purpose of this analysis, such protective efforts are considered to be co-extensive with the protection offered by critical habitat, and costs associated with these efforts are included in this report. 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. In cases where these costs would not have been triggered absent the designation of critical habitat, they are included in this economic analysis.

1.2.3 ADDITIONAL ANALYTIC CONSIDERATIONS

45. This analysis also considers the potential for other types of economic impacts that can be related to section 7 consultations in general and CHD in particular, including time delay, regulatory uncertainty, and stigma impacts.

Time Delay and Regulatory Uncertainty Impacts

46. Time delays are costs due to project delays associated with the consultation process or compliance with other regulations. Regulatory uncertainty costs occur in anticipation of having to modify project parameters (e.g., retaining outside experts or legal counsel to better understand their responsibilities with regard to CHD).

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[25] 16 U.S.C. 1532.

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

[27] 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.

Stigma Impacts

47. 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, changes to private property values associated with public attitudes about the limits and costs of implementing a project in critical habitat are known as "stigma" impacts.

1.2.4 BENEFITS

48. Under Executive Order 12866, OMB directs Federal agencies to provide an assessment of both the social costs and benefits of proposed regulatory actions.[28] 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.[29]

49. 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.[30] *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.*

50. Critical habitat designation 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.

51. It is often difficult to evaluate the ancillary benefits of critical habitat designation. To the extent that the ancillary benefits of the rulemaking may be captured by the market through an identifiable shift in resource allocation, they are factored into the overall economic impact assessment in this report. For example, if habitat preserves are created

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

[29] 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.

[30] Ibid.

to protect a species, the value of existing residential property adjacent to those preserves may increase, resulting in a 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.

1.2.5 GEOGRAPHIC SCOPE OF THE ANALYSIS

52. The geographic scope of the analysis includes areas proposed for CHD and areas excluded from proposed critical habitat under section 4(b)(2) of the Act. The economic impacts of potential designation are estimated for each of these two categories of land identified in the proposed rule. The analysis focuses on activities within or affecting these areas.

53. Impacts are presented at the lowest level of resolution feasible given available data. For spikedace and loach minnow, impacts are reported for each subunit identified in the proposed rule. Section 2 presents maps illustrating the relationship between subunit size, census tracts, and cities.

1.3 ANALYTIC TIME FRAME

54. The analysis estimates impacts 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. This analysis estimates economic impacts to activities from 1986 (year of the species' final listing) to 2025 (20 years from the year of final designation). Forecasts of economic conditions and other factors beyond the next 20 years would be speculative.

1.4 INFORMATION SOURCES

55. The primary sources of information for this report are communications with and data provided by personnel from the Service, Federal action agencies, affected private parties, and local and State governments within Arizona and New Mexico. Specifically, the analysis relies on data collected in communication with personnel from the following entities:

- U.S. Department of Agriculture (USDA), including U.S. Forest Service (USFS);
- U.S. Bureau of Land Management (BLM);
- U.S. Bureau of Reclamation (USBR);
- U.S. Fish and Wildlife Service (Service);
- The Natural Resource Conservation Service (NRCS);
- State agencies, including departments of water resources, agriculture, energy, game and fish, natural resources, recreation, and transportation;
- Various County and City governments;

- Private stakeholder groups, including water facility owners and water distributors, farming and ranching interest groups, development companies, mining companies, and others; and
- The San Carlos Apache Tribe, Yavapai-Apache Nation, and White Mountain Apache Tribe.

56. Publicly available data from the Census Bureau and other Department of Commerce data were relied on to characterize the regional economy. In addition, this analysis relies upon the Service's section 7 consultation records, public comments, and published journal sources. The reference section at the end of this document provides a complete list of information sources.

1.5 STRUCTURE OF REPORT

57. This remainder of this report is organized as follows:

- Chapter 2: Background and Socioeconomic Overview;
- Chapter 3: Potential Economic Impacts to Water Management and Use;
- Chapter 4: Potential Economic Impacts to Livestock Grazing Activities;
- Chapter 5: Potential Economic Impacts to Mining Operations;
- Chapter 6: Potential Costs of Species Management Actions, Including Economic Impacts to Recreation;
- Chapter 7: Potential Economic Impacts to Residential and Commercial Development;
- Chapter 8: Potential Economic Impacts to Tribes;
- Chapter 9: Potential Economic Impacts to Transportation Activities;
- Chapter 10: Potential Economic Impacts to Fire Management Activities;
- References;
- Appendix A: Administrative Costs;
- Appendix B: Small Business and Energy Impacts Analysis;
- Appendix C: Detailed Cost Estimates of Grazing Impacts Presented by Allotment; and
- Appendix D: Summary of Quantified Future Costs by River Segment in Proposed CHD, 2006 – 2025.

CHAPTER 2 | BACKGROUND AND SOCIOECONOMIC OVERVIEW

58. This section provides information on the history of the spikedace and loach minnow listing and describes the socioeconomic characteristics of proposed CHD areas.[31] The proposed CHD for the spikedace and loach minnow traces the path of 633 stream miles in Arizona and New Mexico. The riparian areas along these streams cross through a variety of landscapes, including rural, forest, and Tribal lands, that are subject to variegated economic activities.

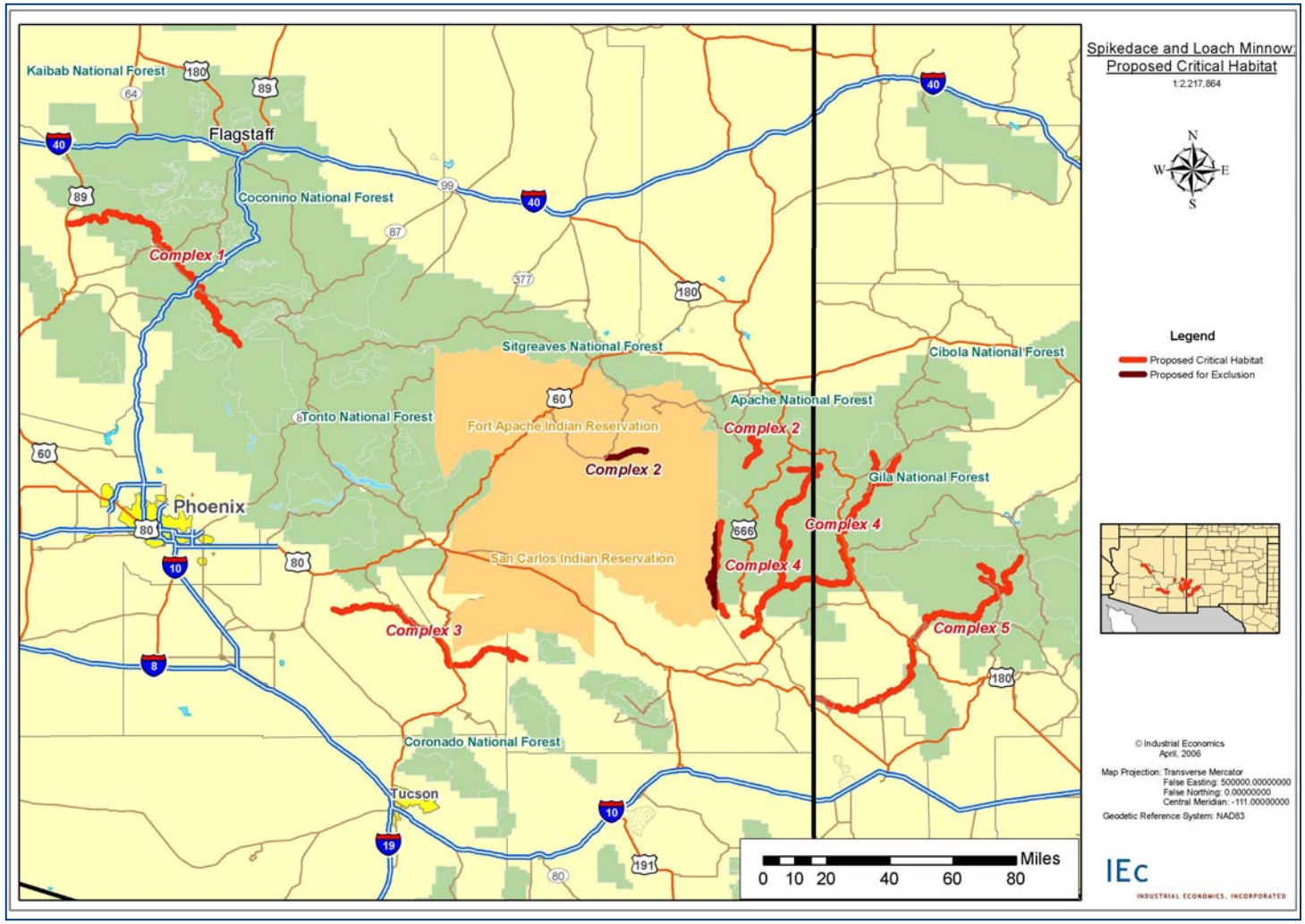
2.1 PROPOSED CRITICAL HABITAT DESIGNATION

59. Both the spikedace and the loach minnow are small, slender fish less than three inches in length. The proposed critical habitat rule (Proposed Rule) describes the two species in detail. Critical habitat has been designated for these species twice previously. These previous designations were in place from 1994 to 1998 and 2000 to 2004. The Service has proposed to designate critical habitat for the spikedace and loach minnow on approximately 633 miles of stream in Arizona and New Mexico (please refer to Exhibit 2-1). Critical habitat includes the wetted channel and the adjacent floodplains within 300 lateral feet on either side of bankfull stage.[32] The current proposed CHD is subdivided into five complexes and 25 stream segments. Exhibit 2-1 presents a map of the proposed CHD for the spikedace and loach minnow.

[31] A detailed discussion of potentially affected Tribal economies is presented in Section 8.

[32] The bankfull stage of the stream is defined by the Service as the discharge at which channel maintenance is the most effective, or the upper level of the range of channel-forming flows which transport the bulk of the available sediment over time.

EXHIBIT 2-1. OVERVIEW OF SPIKEDACE AND LOACH MINNOW PROPOSED CRITICAL HABITAT



60. This analysis approximates the acreage of proposed CHD by creating a buffer of 300 feet on either side of the proposed CHD centerline developed by the Service, using the definition of critical habitat provided in the Proposed Rule (critical habitat includes the wetted channel and the adjacent floodplains within 300 lateral feet on either side of bankfull stage).[33] To estimate land ownership, geographic data of current land ownership was overlaid with CHD polygons using GIS analysis. These estimates of land ownership by stream reach are presented in Exhibit 2-2.

61. As presented in Exhibit 2-2, of the 41,818 acres estimated to comprise the area of proposed CHD for the spikedace and loach minnow, approximately 58 percent are Federal lands (owned by BLM, USBR, or USFS), and another 35 percent are privately owned. Of the remaining, 2 percent are State lands and 5 percent are Tribal lands.

2.2 THREATS TO THE SPECIES AND ITS HABITAT

62. The proposed rule states that, in addition to historic losses, several current human land use activities pose threats to the spikedace and loach minnow. These are:

- Water diversions and groundwater pumping
- Livestock grazing
- Mining
- Non-native species introductions
- Fire management
- Recreation (fishing and off-road vehicle use)
- Road construction and maintenance
- Residential, commercial, and agricultural development

[33] Note that this analysis presents only approximate estimates of land acreage included in critical habitat areas. Please refer to the proposed rule for legal descriptions of proposed CHD.

EXHIBIT 2-2. OWNER CLASSIFICATION OF SPIKEDACE AND LOACH MINNOW CHD AREAS (MI)

COMPLEX	SUB-UNIT	BLM	USBR	FOREST SERVICE	TRIBAL	PRIVATE	STATE	TOTAL
1 Verde River	Verde River	0	0	60	1	43	2	**107**
2 Black River	Boneyard Creek	0	0	1	0	0	0	**1**
	East Fork Black River	0	0	5	0	0	0	**5**
	N. Fork East Fork Black River	0	0	11	0	0	0	**11**
	East Fork White River	0	0	0	12	0	0	**12**
3 Middle Gila/ Lower San Pedro/ Aravaipa Creek	Aravaipa Creek	11	0	0	2	16	0	**28**
	Deer Creek	2	0	0	0	0	0	**2**
	Turkey Creek	3	0	0	0	0	0	**3**
	Gila River	2	7	0	0	27	4	**39**
	San Pedro River	1	0	0	1	11	1	**13**
4 San Francisco River and Blue Rivers	Eagle Creek	0	0	12	17	16	0	**45**
	San Francisco River	8	0	76	0	41	2	**126**
	Tularosa River	0	0	9	0	10	0	**19**
	Frieborn Creek	0	0	1	0	0	0	**1**
	Negrito Creek	0	0	3	0	1	0	**4**
	Whitewater Creek	0	0	0	0	1	0	**1**
	Blue River	0	0	43	0	8	0	**51**
	Campbell Blue Creek	0	0	7	0	1	0	**8**
	Little Blue Creek	0	0	3	0	0	0	**3**
	Dry Blue Creek	0	0	3	0	0	0	**3**
	Pace Creek	0	0	1	0	0	0	**1**
5 Upper Gila River	East Fork Gila River	0	0	21	0	5	0	**26**
	Upper Gila	12	0	48	0	41	1	**102**
	Middle Fork Gila River	0	0	11	0	1	0	**12**
	West Fork Gila River	0	0	5	0	3	0	**8**
Grand Total		**38**	**7**	**321**	**33**	**224**	**10**	**633**
% of Total Stream Miles		6%	1%	51%	5%	35%	2%	100%

Note: Totals may not sum due to rounding/
Sources: IEc analysis of GIS data. GIS data: CHD, Service, Phoenix Ecological Field Services Office, December 2005, Land ownership data GAP/ azgapown.shp, GAP/NMgapown.shp.

2.3 SOCIOECONOMIC PROFILE OF THE CRITICAL HABITAT AREA

63. This section summarizes key economic and demographic information for the counties containing proposed CHD for the spikedace and loach minnow, including population characteristics and general economic activity. County level data are presented to provide context for the discussion of potential economic impacts, and to illuminate trends that may influence these impacts. Although County level data may not precisely reflect the socioeconomic characteristics of the areas immediately surrounding the proposed CHD for the spikedace and loach minnow, these data provide context for the broader analysis.

64. Exhibit 2-3 presents a summary of the counties in which each of the streams proposed for spikedace and loach minnow critical habitat is located.

EXHIBIT 2-3. SPIKEDACE AND LOACH MINNOW CRITICAL HABITAT SEGMENTS BY COUNTY IN ARIZONA AND NEW MEXICO

COMPLEX	COUNTY	RIVER SEGMENTS
1	Yavapai	Verde River
2	Apache, Navajo	East Fork White River, East Fork Black River, North East Fork Black River, Boneyard Creek
3	Pinal, Graham	Gila River, San Pedro River, Aravaipa Creek, Deer Creek, Turkey Creek
4	Greenlee, Catron	Eagle Creek, Blue River, Little Blue Creek, San Francisco River, Negrito Creek, Tularosa River, Campbell Blue Creek, Pace Creek, Dry Blue Creek, Frieborn Creek, Whitewater Creek
5	Hidalgo, Grant, Catron	East Fork Gila River, Upper Gila River, Middle Fork Gila River, West Fork Gila River

2.3.1 POPULATION CHARACTERISTICS

65. The proposed CHD spans an array of urban and rural areas within Arizona and New Mexico. Exhibit 2-4 presents the population size, change in population from 1990 to 2000, per capita income, and poverty rates for the nine counties that have CHD within their boundaries, and for each state as a whole.

66. In Arizona, all counties containing CHD have a lower per capita income than Arizona's average of approximately $20,000. Four of the six counties have higher poverty rates than the State average of about 14 percent. Apache County has the highest poverty rate of these counties with almost 38 percent of all residents living below the poverty threshold. The counties containing CHD in Arizona account for about 14 percent of the State population. Pinal and Yavapai counties are the fastest growing counties with 54.5 and 55.5 percent change (increase) in population between 1990 and 2000, respectively.

67. Within New Mexico, three counties contain CHD, and they represent only about 2.2 percent of the State's population. All three counties have a lower per capita income than New Mexico's average of approximately $17,000. All three counties also have poverty

rates higher than the State average of about 18 percent. Hidalgo County has the highest poverty rate of the three counties with approximately 27 percent of all residents living below the poverty threshold. Catron County is the fastest growing county with a 38.2 percent increase in population between 1990 and 2000, while Hidalgo County experienced a decrease in population over the same period.

EXHIBIT 2-4. SOCIOECONOMIC PROFILE OF COUNTIES CONTAINING CRITICAL HABITAT FOR THE SPIKEDACE AND LOACH MINNOW

STATE	COUNTY	POP. DENSITY (PERSONS/ SQ MI)	POPULATION (2000)	% OF STATEWIDE POPULATION	% CHANGE (1990-2000)	PER CAPITA INCOME (1999)	POVERTY RATE (1999)
Arizona	**State Total**	**45.2**	**5,130,632**	**100%**	**40.0%**	**$20,275**	**13.9%**
	Apache	6.2	69,423	1.4%	12.7%	$8,986	37.8%
	Graham	7.2	33,489	0.7%	26.1%	$12,139	23.0%
	Greenlee	4.6	8,547	0.2%	6.7%	$15,814	9.9%
	Navajo	9.8	97,470	1.9%	25.5%	$11,609	29.5%
	Pinal	33.4	179,727	6.5%	54.5%	$16,025	16.9%
	Yavapai	20.6	167,517	3.3%	55.5%	$19,727	11.9%
New Mexico	**State Total**	**15.0**	**1,819,046**	**100%**	**20.1%**	**$17,261**	**18.4%**
	Catron	0.5	3,543	0.2%	38.2%	$13,951	24.5%
	Grant	7.8	31,002	1.7%	12.0%	$14,597	18.7%
	Hidalgo	1.7	5,932	0.3%	-0.4%	$12,431	27.3%

Source: U.S. Census Bureau, Census 2000 and State County QuicksFacts, accessed at http://quickfacts.census.gov/qfd

68. Of the nine counties containing proposed critical habitat, all have a lower per capita income and have fewer persons per square mile than their respective statewide averages. Although these measures vary considerably, the data suggest that overall the counties are less densely populated, and have a lower per capita income than their state averages.

EXHIBIT 2-5. POPULATION PROJECTIONS FOR COUNTIES CONTAINING PROPOSED CHD FOR THE SPIKEDACE AND LOACH MINNOW, 2005-2025

	COUNTY	POPULATION 2005	POPULATION 2025	PROJECTED PERCENT CHANGE
Arizona	**State**	**5,553,849**	**7,993,039**	**44%**
	Apache	72,236	90,282	25%
	Graham	39,427	54,058	37%
	Greenlee	9,297	10,602	14%
	Navajo	94,395	117,920	25%
	Pinal	181,487	244,422	35%
	Yavapai	175,693	260,779	48%
New Mexico	**State**	**1,970983**	**2,507,548**	**27%**
	Catron	3,829	4,616	21%
	Grant	32,462	36,758	13%
	Hidalgo	5,875	5,515	-6%

Source:
Arizona: July 1, 1997 to July 1, 2050 Arizona County Population Projections, Research Administration, Population Statistics Unit, Arizona.
http://www.workforce.az.gov/admin/uploadedPublications/526_coproj97.xls
New Mexico: Revised Population Projections for New Mexico and Counties, July 1, 2000 to July 1, 2030, Bureau of Business and Economic Research, University of New Mexico. Released August 2002 and revised April 2004.
http:///www.unm.edu/~bber/demo/table1.htm

2.3.2 ECONOMIC ACTIVITY

69. The respective contributions of the various economic activities in counties within the proposed CHD provide insight into the activities most likely to experience potential impacts. Exhibit 2-6 highlights the annual payroll for various industries in the nine counties containing proposed CHD for the spikedace and loach minnow. The principal industries, in terms of annual payroll, include services, retail trade, manufacturing and construction.[34]

70. Exhibit 2-7 provides industry and employment data for all counties that contain proposed CHD for the spikedace and loach minnow. The "Number of Establishments" column displays the total number of physical locations at which business activities were conducted with one or more paid employee in the year 2003. About 11,700 business establishments operate and employ about 121,000 individuals in the counties containing proposed CHD for the spikedace and loach minnow. These figures provide a measure of the average density of commercial and industrial establishments in the region.

[34] Services sectors include professional, scientific & technical services; management of companies & enterprises; admin, support, waste management, remediation services; educational services; health care and social assistance; arts, entertainment & recreation; accommodation & food services; and other services (excluding public administration).

71. The largest employment sectors within the counties containing CHD are services, retail trade, and construction. Employment within the services sector represented approximately 48.8 percent of the job base while employment within the retail trade constituted 18.9 percent of all jobs in the counties. Construction employment accounted for nearly 8.6 percent of all jobs. While riparian habitat constitutes a small portion of the land area in these counties, the overall demographic information allows for a better understanding of the economies potentially affected by CHD.

72. The significance of specific industries within the counties follow a similar pattern to the state-level figures. The "services and other" industry has the largest number of employees, establishments, and highest amount of payroll in all counties. In most of these counties, retail trade is the second most prevalent industry. In the fast-growing counties of Pinal and Yavapai, manufacturing and construction are large industries.

EXHIBIT 2-6. ECONOMIC ACTIVITY WITHIN COUNTIES CONTAINING SPIKEDACE AND LOACH MINNOW CRITICAL HABITAT ANNUAL PAYROLL BY INDUSTRY ($ THOUSANDS)

	ARIZONA								NEW MEXICO				
INDUSTRY	APACHE	GRAHAM	GREENLEE	NAVAJO	PINAL	YAVAPAI	SIX COUNTY TOTAL	% OF STATE TOTAL	CATRON	GRANT	HIDALGO	THREE COUNTY TOTAL	% OF TOTAL STATE
Agriculture, Forestry, Hunting, and Fishing Support	0	0	0	1662	3742	173	**5577**	13.2%	0	0	0	**0**	0.0%
Mining	0	0	0	45717	7019	35304	**88040**	25.2%	0	0	0	**0**	0.0%
Utilities	0	0	0	23451	11358	12151	**46960**	7.5%	0	0	0	**0**	0.0%
Construction	4910	5953	611	37231	41768	159329	**249802**	4.4%	0	19742	450	**20192**	7.2%
Manufacturing	0	6281	0	42228	92697	112770	**253976**	3.6%	0	4051	0	**4051**	0.3%
Wholesale Trade	0	4405	0	11312	22806	48896	**87419**	2.3%	846	2161	0	**3007**	0.4%
Retail Trade	19436	24348	1812	79454	114289	187874	**427213**	6.8%	0	21216	4255	**25471**	1.4%
Transportation/ Warehousing	2249	2986	0	12781	15159	20245	**53420**	1.8%	0	2240	324	**2564**	0.5%
Information	6165	2200	0	14054	10308	23998	**56725**	2.1%	0	6234	274	**6508**	1.3%
Finance and Insurance	0	3177	0	11394	7793	54130	**76494**	1.4%	0	6063	0	**6063**	0.7%
Real Estate	0	2339	0	5998	3429	28711	**40477**	3.1%	0	1632	0	**1632**	0.7%
Unclassified	0	0	0	0	107	368	**475**	3.3%	12	88	0	**100**	3.0%
Services and Other Industries	80528	32950	0	196296	337500	533610	**1100356**	3.9%	449	66899	5260	**72608**	1.0%

Source: U.S. Census Bureau, 2003 County Business Patterns, accessed at http://censtats.census/gov/cbpnaic/cbpnaic.shtml

EXHIBIT 2-7. ECONOMIC ACTIVITY WITHIN COUNTIES CONTAINING SPIKEDACE AND LOACH MINNOW CHD NUMBER OF ESTABLISHMENTS AND EMPLOYEES BY INDUSTRY (2003)

		ARIZONA								NEW MEXICO				
INDUSTRY		APACHE	GRAHAM	GREENLEE	NAVAJO	PINAL	YAVAPAI	SIX COUNTY TOTAL	% OF STATE TOTAL	CATRON	GRANT	HIDALGO	THREE COUNTY TOTAL	% OF TOTAL STATE
Agriculture, Forestry, Hunting, and Fishing Support[1]	Employees	19	99	0	66	139	12	**335**	18.5%	284	19	19	**322**	74.2%
	Establishments	9	5	0	14	13	11	**52**	22.1%	73	1	1	**75**	75.0%
Mining	Employees	19	19	2499	833	159	913	**4442**	58.2%	19	999	0	**1018**	7.5%
	Establishments	3	2	2	8	13	17	**45**	25.0%	4	8	0	**12**	2.0%
Utilities	Employees	19	249	99	422	218	249	**1256**	12.4%	19	99	19	**137**	2.7%
	Establishments	7	4	4	17	16	23	**71**	27.2%	3	6	3	**12**	5.4%
Construction	Employees	215	260	42	1561	1511	5928	**9517**	5.8%	99	775	24	**898**	2.0%
	Establishments	62	47	10	325	258	1022	**1724**	12.7%	9	84	11	**104**	2.1%
Manufacturing	Employees	249	271	19	1089	2773	3383	**7784**	4.7%	19	137	99	**255**	0.8%
	Establishments	11	14	1	44	88	202	**360**	7.5%	2	13	3	**18**	1.2%
Wholesale Trade	Employees	99	173	99	353	637	1653	**3014**	3.4%	0	156	99	**255**	1.2%
	Establishments	10	15	5	59	88	169	**346**	5.3%	0	18	2	**20**	1.0%
Retail Trade	Employees	1290	1245	121	3868	5935	8875	**21334**	7.6%	52	1240	247	**1539**	1.7%
	Establishments	117	101	16	302	434	797	**1767**	10.1%	12	129	35	**176**	2.4%
Transportation /Warehousing	Employees	89	78	99	431	458	816	**1971**	2.3%	19	126	15	**160**	1.0%
	Establishments	22	26	4	45	80	114	**291**	10.3%	3	22	8	**33**	2.7%

INDUSTRY		ARIZONA								NEW MEXICO				
		APACHE	GRAHAM	GREENLEE	NAVAJO	PINAL	YAVAPAI	SIX COUNTY TOTAL	% OF STATE TOTAL	CATRON	GRANT	HIDALGO	THREE COUNTY TOTAL	% OF TOTAL STATE
Information	Employees	149	90	19	357	312	797	**1724**	3.1%	19	255	10	**284**	1.9%
	Establishments	16	11	6	28	40	76	**177**	8.0%	1	21	4	**26**	3.1%
Finance and Insurance	Employees	99	103	19	454	743	1488	**2906**	2.6%	19	230	99	**348**	1.4%
	Establishments	19	22	4	80	99	295	**519**	6.2%	1	42	5	**48**	1.8%
Real Estate	Employees	99	127	19	261	709	1046	**2261**	5.3%	19	108	19	**146**	1.5%
	Establishments	23	25	3	94	139	342	**626**	8.8%	3	38	1	**42**	1.9%
Unclassified	Employees	19	19	19	19	6	40	**122**	17.7%	1	4	0	**5**	2.1%
	Establishments	6	6	1	9	8	18	**48**	9.4%	3	4	0	**7**	4.1%
Services and Other Industries	Employees	3715	2860	542	8960	14662	23972	**54711**	5.6%	227	3581	527	**4335**	1.5%
	Establishments	220	224	33	784	1022	2406	**4689**	8.2%	30	320	36	**386**	2.0%

SOURCE: U.S. Census Bureau, 2003 County Business Patterns, accessed at http://censtats.census/gov/cbpnaic/cbpnaic.shtml

NOTE: Some employment figures were presented as a range; the high-end of the range is used

[1] This information was provided by the census which uses NAICS code 11 to define Agriculture, Forestry, Hunting, and Fishing Support. NAICS code definitions are available through http://www.census.gov/epcd/naics02/naicod02.htm. Other data on the number of farm and ranching operations are available in Appendix B, Exhibits B2 through B-4.

CHAPTER 3 | POTENTIAL ECONOMIC IMPACTS TO WATER MANAGEMENT AND USE

73. This section examines the past and future economic effects resulting from spikedace and loach minnow conservation activities affecting water use and users within proposed spikedace and loach minnow CHD. This section presents an overview of the methodology used to evaluate water use activities and associated economic impacts, background information, and estimated impacts by river segment.

3.1 SUMMARY OF IMPACTS

74. Past modifications to water supply and diversion projects in proposed CHD areas have generally not involved water quantity or water flow issues. Instead, they involved modest changes to a few projects, primarily involving water diversion repair. Total past project modification costs are estimated to be $221,000 from 1986 to 2005 ($2005).[35] Administrative costs associated with past conservation efforts under section 7 of the ESA, including 17 formal, 41 informal, and 51 technical assistance efforts for water-related activities are estimated to be $435,000 to $1.1 million from 1986 to 2005. Administrative costs are detailed in Appendix A.

75. Exhibit 3-1 presents a summary of future costs related to water management and use. Anticipated project modification costs are estimated to be $160,000 for project modifications similar to those conducted for past projects, assuming a discount rate of 7 percent (2005$). Administrative costs are estimated to continue at the same rate as the past, totaling $435,000 to $1.1 million (undiscounted 2005$) over the next 20 years.

76. In addition to these impacts, impacts on water users are possible if less water is made available for diversion to accommodate the spikedace and loach minnow. However, there are currently no data that indicates whether existing or future diversions of water (including groundwater use) reduce stream flow or modify hydrologic conditions to a degree that adversely impact the spikedace and loach minnow or their habitat. In addition, hydrologic models are unavailable to assess the role of any specific groundwater pumping activity or surface water diversion in determining stream flow or other hydrologic conditions within critical habitat. As such, this analysis does not quantify the probability or extent to which water use would need to be curtailed or modified to remedy impacts on spikedace and loach minnow. It does, however, provide information on the potential scale of the economic impacts that could occur if requirements associated with

[35] Costs associated with a plan to address non-native species issues associated with operations of the Central Arizona Project are included in Section 6.

spikedace and loach minnow conservation result in changes in water diversions or conveyance. [36]

77. Specifically, irrigated agriculture may adversely affect spikedace and loach minnow proposed CHD areas by affecting water quality, altering habitat and reducing water availability. As with other water use activities, agricultural irrigation activity has generally not been affected by spikedace and loach minnow conservation activities since the listing of the two species in 1986 (i.e., past project modifications to agricultural activities have not occurred other than consultations on diversion repair).

78. However, it is possible that irrigation activities could be affected if farmers make efforts to maintain adequate water quantity and flow for the species in the future. Because agricultural water use comprises 98 percent of surface water use and 81 percent of groundwater use in counties that contain critical habitat, it appears most likely that, if additional water supplies are needed for these species, they would come from current agricultural water use. Thus, the analysis assumes that to accommodate spikedace and loach minnow, farmers may give up water and cease to farm, resulting in losses of agricultural land value.

79. Should irrigated agriculture be curtailed to accommodate spikedace and loach minnow, approximately 830 acres within proposed CHD, or 6,310 acres that fall in the vicinity of CHD that are currently irrigated for cropland agriculture could be retired from production. The irrigated crop production at risk of being lost is valued at approximately $4.5 million ($2005) within proposed CHD areas, or approximately $38.5 million ($2005) including lands that rely on water diverted from proposed CHD. Thus, the total cropland value potentially foregone ($38.5 million in $2005) is included in high end estimates of impacts on water use. [37]

[36] Potential impacts to water use for mining activities are discussed in Chapter 5. Potential impacts to Tribal water use are discussed in Chapter 8. It should be noted that lands of the San Carlos Apache and White Mountain Apache are proposed for exclusion from critical habitat for the spikedace and loach minnow.

[37] The value added of cropland is estimated as the difference in land value between irrigated farmland (i.e. cropland) and non-irrigated farmland (i.e. pasture), using USDA estimates of cropland values and pasturelands.

EXHIBIT 3-1. SUMMARY OF FUTURE IMPACTS TO WATER USERS. 2006-2025

COMPLEX	RIVER SEGMENT	FUTURE COSTS (UNDISCOUNTED DOLLARS)		PRESENT VALUE 3%		PRESENT VALUE 7%		OTHER POTENTIAL IMPACTS [1]
		LOW	HIGH	LOW	HIGH	LOW	HIGH	TYPE
Complex 1	Verde River	$120,000	$30,421,000	$90,000	$29,507,000	$64,000	$28,382,000	City of Prescott water supply
Complex 3	Aravaipa Creek	$20,000	$3,134,000	$15,000	$3,038,000	$11,000	$2,921,000	None
	Gila River	$41,000	$41,000	$30,000	$30,000	$21,000	$21,000	Mining
	San Pedro River	$0	$4,459,000	$0	$4,329,000	$0	$4,167,000	Mining
Complex 4	Eagle Creek	$41,000	$41,000	$30,000	$30,000	$21,000	$21,000	San Carlos Apache, Mining
	San Francisco River	$0	$11,000	$0	$11,000	$0	$10,000	None
	Blue River	$81,000	$81,000	$60,000	$60,000	$43,000	$43,000	None
Complex 5	East Fork Gila River	$0	$2,000	$0	$2,000	$0	$2,000	None
	Upper Gila River	$0	$588,000	$0	$571,000	$0	$549,000	Mining
	West Fork Gila River	$0	$7,000	$0	$6,000	$0	$6,000	None
TOTAL		**$303,000**	**$38,783,000**	**$225,000**	**$37,585,000**	**$160,000**	**$36,123,000**	

[1] Potential impacts to mining activities that utilize surface water in proposed CHD are discussed in Chapter 5, and are not included in quantified impacts here. Potential impacts to Tribes are discussed in Chapter 8. It should be noted that lands of the San Carlos Apache and White Mountain Apache are proposed for exclusion from critical habitat for the spikedace and loach minnow.

3.2 APPROACH TO ANALYSIS OF WATER MANAGEMENT AND USE

80. Historically, the Service has been most concerned with the threat of non-native species introductions/presence, rather than the *quantity* of water available for the spikedace and loach minnow.[38] Nonetheless, the Proposed Rule states that spikedace and loach minnow need permanent, flowing water. The Service also states that the spikedace and loach minnow are less likely to occur where substantial diversions or impoundments have been constructed, and that these fish survive better when rivers have natural flow regimes, including flood events. The Proposed Rule lists water diversions as a threat to nine river segments. Thus, while not a focal point of most past consultations, having adequate water flow is critical to these fish.

81. Because the climate in which the fish live is arid, water is scarce. The top concern of water users and managers in proposed CHD areas is impacts on the availability of water for use.[39] Thus, this analysis focuses on identifying stream segments where water diversions may impact flow regimes to such a degree that proposed CHD areas may be affected. The analysis then discusses how water uses or points of diversion locations may be required to change to accommodate spikedace and loach minnow. Actions evaluated for effects on proposed CHD include water diversions repair/construction, groundwater pumping, and dam construction/repair/maintenance.

82. The Proposed Rule states that water depth requirements for the spikedace and loach minnow can be as little as one inch (adult loach minnow) to 1.2 inches (juvenile/larval spikedace) to as much as one meter. Flow velocities vary from one inch/second (juvenile loach minnow) to 34 inches/second (juvenile loach minnow). Ideally, this analysis would consider streamflow requirements for the spikedace and loach minnow coupled with actual flow data for each area to identify and quantify potential impacts associated with proposed CHD for the spikedace and loach minnow. However, it is difficult to rely on this approach due to several important uncertainties, including 1) the volume of water needed to augment flow in a given year to benefit the spikedace and loach minnow; 2) the relationship between water withdrawals and river flow in proposed CHD areas; 3) future water demand and management activities. Thus, this analysis relies on both quantitative and qualitative assessments of water use and demand in proposed CHD areas to understand potential impacts. Specifically, this analysis was conducted in five steps:

1) **Identify past impacts of spikedace and loach minnow conservation on water use and management.**

2) **Identify water users in proposed CHD areas**:

   - United States Geological Survey (USGS), Arizona Department of Water Resource (AZDWR), and New Mexico State Engineer Office (NMSEO) water withdrawal data were queried to understand annual

[38] See Section 6 for a detailed discussion of activities related to non-native species removal.

[39] One public comment underscores the importance of water availability in one area by stating that "the potential loss of the ability to diver surface water and possibly groundwater is perhaps the most important economic, social, and environmental consideration in the Verde River unit." Public comments of David A. Brown and Michael J. Brown, Brown& Brown Law Offices, on behalf of Park Central Properties and NBJ Ranch Limited Partnership, July 6, 2006.

surface water and groundwater use in proposed CHD areas. This assessment identified irrigation as the primary use of both surface water (98 percent of withdrawals) and groundwater (81 percent of withdrawals) in counties containing proposed CHD. It also identified public/domestic water supply as an important user of groundwater (nine percent) in affected counties.

- AZDWR and NMSEO groundwater well data were overlaid with proposed CHD areas using GIS to identify groundwater wells in proposed CHD areas.[40] This assessment identified 501 groundwater wells that fall within proposed CHD, of which most are small wells used to serve single-family homes for domestic purposes. It also found that groundwater wells are clustered geographically: 322 of 501 groundwater wells in proposed CHD (63 percent) are found in the Verde River segment of proposed CHD. Most of those wells are found in the Lower Verde portion of the Verde River segment.
- Public comments on the Proposed Rule, past Proposed Rules, and Rules relating to other native fish in Arizona and New Mexico were reviewed. This assessment identified several concerned water user groups who were contacted and interviewed.

3) **Assess impacts on cropland agriculture**. Irrigated agriculture may adversely affect spikedace and loach minnow proposed CHD areas by affecting water quality, altering habitat, and affecting water availability. However, agricultural lands used for growing crops generally have not been affected by spikedace and loach minnow conservation activities since the listing of the two species in 1986 (i.e., past project modifications to agricultural activities have not occurred). One potential Federal nexus involves Federal funding received by farmers as part of farm assistance programs.

   Because the vast majority of water used in proposed CHD is for irrigation purposes, and because the agricultural community has expressed concern,[41] the analysis looks closely at potential impacts to cropland agriculture. Responses by farmers to avoid impacts on spikedace and loach minnow habitat could result in adverse impacts to the farming community in the future. The analysis quantifies potential impacts of reduced water availability

[40] Note that this analysis presents only approximate estimates of land acreage included in critical habitat areas. Please refer to the Proposed Rule for legal descriptions of proposed CHD. This analysis approximates the acreage of proposed CHD by creating a buffer of 300 feet on either side of the proposed CHD centerline. The centerline was developed by the Service, and the analysis then uses a 300 foot buffer in an effort to best approximate the definition of critical habitat provided in the Proposed Rule (Critical habitat includes the wetted channel and the adjacent floodplains within 300 lateral feet on either side of bankfull stage).

[41] See for example, Public comments of the Black Range Resource Conservation and Development District, Inc, re: Proposed Designation of Critical Habitat for the Spikedace and Loach Minnow," January 11, 2000.

on agricultural production, as well as potential reduced participation in Federal assistance programs that could result.

- **Reduced agricultural production.** If water currently used for agriculture were reallocated to instream flow, either through purchase, exchange, or otherwise in order to avoid adverse impacts on spikedace and loach minnow, the agricultural lands would most likely cease to be farmed. This is because irrigation is necessary for farming in the Southwest, and few substitute water supplies exist.[42] This analysis calculates the economic value of agricultural resources that fall within proposed CHD, and the value of resources that rely on water withdrawals from proposed CHD. The analysis estimates the increased value of agricultural lands over unimproved lands using USDA estimates of cropland values and pasturelands. The difference between these land values is used to estimate the value added by crop agriculture, as shown in Exhibit 3-2.

EXHIBIT 3-2. CROP AND PASTURE LAND VALUES USED TO CALCULATE VALUE OF CROPS IN PROPOSED CHD (2005$)

STATE	VALUE OF CROPLAND PER ACRE [1]	VALUE OF PASTURELAND PER ACRE	DIFFERENCE (INCREMENTAL VALUE OF CROP PRODUCTION)
AZ	$ 6,790	$ 600	$ 6,190
NM	$ 3,370	$ 195	$ 3,175

[1] Reported irrigated cropland values.
Source: USDA NASS, Agricultural Land Values and Cash Rents, 2005 Summary; http://www.usda.gov/nass/aggraphs/landcash.htm on Feb 1, 2006.

- **Reduced participation in Federal funding activities.** Agricultural activities on private lands may be supported by voluntary participation in a number of programs sponsored by Federal agencies, including the NRCS and the Farm Service Agency (FSA). These agencies provide funding and technical assistance for agriculture-related activities. It is possible that, fearing that receiving Federal funding would potentially require them to bear the burden of maintaining fish habitat, irrigators could decline participation in Federal programs. To address this potential impact, the analysis quantifies the approximate value of Federal funding received by farming communities in proposed CHD. It should be noted that NRCS staff state that funds not allocated within proposed CHD would likely be reallocated within the state. NRCS also questions the assumption that farmers would refuse funding to avoid a Federal

[42] The likelihood of these water transfers, and the mechanism by which this may occur, are unknown.

nexus, particularly as its awards typically go to farmers who wish to promote conservation. As a result, these potential impacts are not included in estimated costs.[43]

4) **Assess impacts on public water supply/domestic use**. Because the majority of domestic and municipal water uses occur in the Verde River segment, the analysis focuses on Complex 1 in its assessment of potential impacts to domestic and municipal water supplies. Interviews with water users and managers identified particular areas of concern as well as potential costs within the Verde River segment.

5) **Assess impacts to Tribal water use and industrial use of water for mining**. Potential impacts to mining activities that utilize surface water in proposed CHD are discussed in Chapter 5. Potential impacts to Tribes are discussed in Chapter 8. It should be noted that lands of the San Carlos Apache and White Mountain Apache are proposed for exclusion from critical habitat for the spikedace and loach minnow.

3.3 PAST IMPACTS ON WATER USE IN PROPOSED CHD AREAS

83. As stated previously, the majority of past consultations on water issues did not focus on water availability or water quantity issues. Instead, consultations focused on non-native species reintroduction issues for multiple native fish species, diversion repair and bank stabilization-type projects, and occasionally, proposed water exchanges.

84. One past consultation with the Department of Defense at Fort Huachuca (which lies outside of proposed CHD) addressed groundwater use at the installation as it related to native fish and native plant species. As a result of this consultation, the Army agreed to limit its groundwater use to accommodate these species in the Upper San Pedro River, which is not proposed as CHD for the spikedace and loach minnow.[44] Because it appears that one remedy for low water situations in streams may be to reduce groundwater pumping, this analysis looks closely at the groundwater uses that occur within critical habitat areas, and assesses the extent to which they could be affected by spikedace and loach minnow conservation activities. However, it should be noted that because groundwater withdrawals frequently do not involve a Federal nexus, groundwater issues have rarely been addressed through section 7 consultations in the past. For example, the City of Sierra Vista has not consulted with the Service nor has it opted to undertake the same water conservation strategy as the Federally owned Fort Huachuca, though they share groundwater resources. Other past impacts on water use and management in CHD areas include:

[43] Personal communications with Eric Banks, NRCS, Arizona, February 1, 2006; Personal communication with Mike Neubeiser, NRCS, New Mexico, February 2, 2006.

[44] U.S. Department of the Interior, Fish and Wildlife Service, Re-initiation of Consultation on Fort Huachuca Programmatic Biological Opinion (2-21-02-F-229 and 2-21-98-F-266), August 23, 2002.

- **Complex 1, Verde River: Operation of Horseshoe/Bartlett Reservoirs.** While no Salt River Project (SRP) facilities fall in proposed CHD areas, SRP has water rights to a large portion of the flow of the Verde River, and is currently engaged in developing a HCP in the Verde River Watershed for Horseshoe and Bartlett Reservoirs, which are located downstream of proposed CHD for the spikedace and loach minnow. The HCP covers many species, including several native fish species. These species include: razorback sucker, Colorado pikeminnow, Gila topminnow, spikedace, loach minnow, roundtail chub, desert sucker, Sonoran sucker, longfin dace and speckled dace. As part of the HCP process, SRP expended $442,900 in studies, administrative, and legal costs and $15,000 in survey costs associated with native fish species to be covered under the HCP. Estimates do not include in-house staff time spent by SRP. SRP estimates that approximately 10 percent of native fish costs are attributable to spikedace and loach minnow conservation, or $45,000.[45]
- **Complex 1, Verde River: Low-Flow Gauge.** In addition to HCP efforts, SRP was involved with a 2003 consultation regarding installation of a low-flow gauge with a flume on the Campbell Ranch to measure flow in the Verde River near its headwaters (the Upper Verde portion of the Verde River segment). This action required a section 404 permit from US Army Corps of Engineers (USACE). Following consultation, the total project costs were $142,600, of which SRP estimates $13,500 were spent on conservation activities attributable to spikedace and loach minnow concerns, including estimated in-kind fish survey expenses incurred by the Arizona Game and Fish Department (AZGFD).
- **Complex 3, Gila River: San Carlos Water Exchange.** In 2004, USBR consulted with the Service on a proposal to exchange up to 20,000 acre-feet of CAP water with the San Carlos Apache Tribe to be supplied downstream of Coolidge Dam on the Gila River (in Complex 3 of proposed CHD). The exchange of water would have allowed the San Carlos Apache to maintain a minimum water level in the Lake to avoid possible fish kills and impacts on recreation and wildlife. The biological opinion recommended that USBR undertake a variety of activities, including additional research and monitoring, installation of meters, and reporting.[46] However, the project did not take place in 2004 for reasons unrelated to spikedace and loach minnow.[47] Because this project has not been implemented to date, past costs of spikedace and loach minnow consist only of administrative costs.

[45] Written communication with C. Sommers, ERO Resources, " Re: Critical Habitat Economic Analysis, Spikedace and Loach Minnow," February 2, 2005.

[46] U.S. Fish and Wildlife Albuquerque Regional Office. 2004. Biological opinion on the Bureau of Reclamation's Approval of Water Exchange by the San Carlos Apache Tribe for Retention in San Carlos Reservoir, March 8.

[47] Personal communication with Susan Montgomery, Sparks, Tehan & Riley, Special Counsel to the San Carlos Apache Tribe, February 14, 2006.

- **CAP Project.** One consultation for which a final biological opinion was issued in 2001 with USBR considered potential nonnative species introductions that could occur as part of interbasin water transfer through the CAP. This consultation resulted in a number of off-site modifications that were implemented by USBR, including an agreement to install numerous non-native fish barriers, monitor fish populations, and fund non-native fish recovery efforts annually for 21 years. Several mitigation efforts for this opinion have been undertaken within proposed CHD. Costs associated with implementing this biological opinion are included in Section 6.
- **Other** past consultations in proposed CHD areas have resulted in relatively modest changes to proposed projects. Typical project modifications have included minimizing activities within the wetted channel, ensuring no pollutants enter surface waters, replanting riparian vegetation, monitoring for up to ten years, and conducting research studies. These modifications have been recommended for approximately 10 diversion repair and bank stabilization-type projects (not including SRP's low-flow gauge). Project modification costs are assumed to have been the same as SRP costs for its low-flow gauge project, or a total of $135,000.

Total past project modification costs associated with spikedace and loach minnow in proposed CHD areas are estimated to have been $221,000 ($2005) between the years of 1986 and 2005. Administrative costs associated with past consultations related to water use and management are estimated to be $435,000 to $1.1 million ($2005).

3.4 IDENTIFICATION OF WATER USERS IN PROPOSED CHD AREAS

85. In counties that contain proposed CHD, agricultural water use, primarily for crop irrigation, represents 98 percent of surface water withdrawals, as presented in Exhibit 3-3.[48] In affected counties, water is only used for public water supplies in Pinal County, Arizona, and Grant County, New Mexico. Surface water withdrawals in Pinal County dominate withdrawals among affected counties. However, much of the surface water supply in Pinal County is derived from Lower Colorado River water that is provided via the CAP, and which lies outside of proposed CHD for the spikedace and loach minnow.

86. Total groundwater withdrawals in affected counties exceed surface water withdrawals. As presented in Exhibit 3-4, groundwater use is also dominated by irrigation, which represents 81 percent of groundwater withdrawals in affected counties. Pinal County, which has the largest agricultural production in Arizona, also dominates groundwater use in affected counties.

[48] Estimated Use of Water in the United States, County-Level Data for 2000, USGS, Freshwater Use estimates. Accessed at http://water.usgs.gov/watuse/data/2000/.

EXHIBIT 3-3. SURFACE WATER USE IN COUNTIES CONTAINING SPIKEDACE AND LOACH MINNOW CRITICAL HABITAT, MGD (2000)

STATE	COUNTY	CHD ACRES IN COUNTY	PUBLIC WATER SUPPLY [1]	IRRIGATION	MINING	TOTAL
Arizona	Apache	1,301	0.00	20.44	0.00	20.44
	Gila	2	0.00	1.30	0.21	1.51
	Graham	1,777	0.00	43.91	0.00	43.91
	Greenlee	8,824	0.00	4.02	4.16	8.18
	Navajo	657	0.00	1.34	0.00	1.34
	Pinal	5,127	5.42	501.95	0.01	507.38 [2]
	Yavapai	7,073	0.00	11.55	0.00	11.55
New Mexico	Catron	9,495	0.00	17.52	n/a	17.52
	Grant	6,629	0.16	23.01	n/a	23.17
	Hidalgo	933	0.00	7.81	n/a	7.81
Total		**41,818**	**5.58**	**632.85**	**4.38**	**642.81**
Percent of Total			**1%**	**98%**	**1%**	**100%**

Notes:

[1] One MGD for a year is equivalent to the annual water use by approximately 2,550 households.

[2] Much of the surface water supply in Pinal County is derived from Lower Colorado River water that is provided via the Central Arizona Project, and which lies outside of proposed CHD for the spikedace and loach minnow.

Source: Estimated Use of Water in the United States, County-Level Data for 2000, USGS, Freshwater Use estimates. Accessed at http://water.usgs.gov/watuse/data/2000/

EXHIBIT 3-4. GROUNDWATER USE IN COUNTIES CONTAINING SPIKEDACE AND LOACH MINNOW CRITICAL HABITAT, MILLION GALLONS PER DAY (MGD) (2000)

STATE	COUNTY	CHD ACRES IN COUNTY	PUBLIC WATER SUPPLY	DOMESTIC [1]	INDUSTRIAL	IRRIGATION	MINING	THERMOELECTRIC	TOTAL
Arizona	Apache	1,301	5.00	2.48	0.00	3.74	0.00	15.96	27.18
	Gila	2	5.82	0.94	0.00	4.60	1.91	0.00	13.27
	Graham	1,777	4.79	0.51	0.00	122.83	0.17	0.00	128.3
	Greenlee	8,824	0.59	0.16	0.00	9.65	6.68	0.00	17.08
	Navajo	657	10.30	1.45	12.16	27.24	4.35	13.12	68.62
	Pinal	5,127	28.90	2.72	1.86	507.8	2.93	0.84	545.06
	Yavapai	7,073	22.61	3.20	0.00	25.32	19.72	0.00	70.85
New Mexico	Catron	9,495	0.15	0.20	0.00	0.30	n/a	0.00	0.65
	Grant	6,629	3.65	0.69	0.01	3.66	n/a	0.25	8.26
	Hidalgo	933	0.81	0.17	0.01	29.60	n/a	0.00	30.59
Total		**41,818**	**82.62**	**12.52**	**14.04**	**734.75**	**35.76**	**30.17**	**909.86**
Percent of Total			**9%**	**1%**	**2%**	**81%**	**4%**	**3%**	**100%**

Note:

[1] One MGD of domestic water use is equivalent to the annual water use by approximately 2,550 households assuming that each household uses 0.44 acre-feet per year, and the average gallons per capita per day (GPCD) delivered is 166 gallons. Pearson, Rita, Verde Watershed Study, Arizona Department of Water Resources, 2000.

Source: Estimated Use of Water in the United States, County-Level Data for 2000, USGS, Freshwater Use estimates. Accessed at http://water.usgs.gov/watuse/data/2000/.

87. Exhibit 3-5 presents detailed information on the location and type of the 501 groundwater wells that appear to fall in proposed CHD.[49] The majority of wells in proposed CHD are used for domestic purposes (83 percent). The majority (79 percent) of wells in proposed CHD are small domestic wells in Arizona (wells pumping less than 35 gallons per minute (gpm)).[50]

88. Of the 68 wells in Arizona that pump more than 35 gpm, 39 are irrigation wells (58 percent), 19 are domestic wells (28 percent), seven are industrial wells (ten percent), and two are used for other purposes (three percent).

[49] Arizona Department of Water Resources, Wells 55 Database CD, 2002; New Mexico Office of the State Engineer, W.A.T.E.R.S. (Water Administration Technical Engineering Resource System) Project, GIS data, accessed at http://www.ose.state.nm.us/water-info/gis-data/index.html on January 16, 2006. This database is a record of all wells registered with the state of Arizona since reporting began in 1980 (though many wells were reported to the state retroactively). The positional accuracy of the data is somewhat limited because the well locations are reported to ADWR by township, range, section and section subdivision down to the nearest ten acres (quarter-quarter-quarter section). Thus, center points of ten-acre cells are used to represent the approximate locations of the wells. In addition, 0.05 percent of the wells in the database have no locational information. Thus, in some cases, wells may have been identified as falling within critical habitat when they do not, and vice versa.

[50] Wells pumping less than 35 gpm would be exempt from reporting requirements if they occur in an Active Management Area (AMA). Outside of AMAs, there are no reporting requirements for groundwater wells. Personal communication with W. Werner, Arizona Department of Water Resources, March 22, 2006.

EXHIBIT 3-5. NUMBER OF GROUNDWATER WELLS LOCATED IN SPIKEDACE AND LOACH MINNOW PROPOSED CRITICAL HABITAT AREAS

COMPLEX	RIVER SEGMENT	DOMESTIC	INDUSTRIAL	IRRIGATION	STOCK	UTILITY	TOTAL
1	Verde River*	287	0	30	4	1	322
2	East Fork Black River	1	0	0	0	0	1
3	Aravaipa Creek	31	0	9	2	0	42
	Gila River	8	7	5	1	0	21
	San Pedro River	18	0	4	0	0	22
4	Blue River	7	0	2	0	0	9
	Eagle Creek	3	0	1	2	0	6
	San Francisco River	24	0	7	2	0	33
	Tularosa River	7	0	0	0	0	7
	Whitewater Creek	9	0	1	0	0	10
5	East Fork Gila River	4	0	0	0	0	4
	Gila River	11	1	3	1	0	16
	West Fork Gila River	8	0	0	0	0	8
Total		**418**	**8**	**62**	**12**	**1**	**501**
Percent		**83.4%**	**1.6%**	**12.4%**	**2.4%**	**0.2%**	**100.0%**

Source: Arizona Department of Water Resources, Wells 55 Database CD, 2002; New Mexico Office of the State Engineer, W.A.T.E.R.S. (Water Administration Technical Engineering Resource System) Project, GIS data, accessed at http://www.ose.state.nm.us/water-info/gis-data/index.html on January 16, 2006. This database is a record of all wells registered with the state of Arizona since reporting began in 1980 (though many wells were reported to the state retroactively). The positional accuracy of the data is somewhat limited because the well locations are reported to ADWR by township, range, section and section subdivision down to the nearest ten acres (quarter-quarter-quarter section). Thus, center points of ten-acre cells are used to represent the approximate locations of the wells. In addition, 0.05 percent of the wells in the database have no locational information. Thus, in some cases, wells may have been identified as falling within critical habitat when they do not, and vice versa.

*Most of the groundwater wells on the Verde River segment are found in the Lower Verde reach of the Verde River segment.

3.5 IDENTIFYING FUTURE ECONOMIC IMPACTS RELATED TO WATER SUPPLY

89. While potential administrative costs and impacts on existing infrastructure are relatively well understood, potential impacts on municipal, agricultural, Tribal, and industrial water use that could result from spikedace and loach minnow conservation are, in large part, uncertain.[51] As described above, few impacts on water use have occurred in the past. In

[51] Potential impacts to water use for mining activities are discussed in Chapter 5. Potential impacts to Tribal water use are discussed in Chapter 8. It should be noted that lands of the San Carlos Apache and White Mountain Apache are proposed for exclusion from critical habitat for the spikedace and loach minnow.

fact there is only one known example of impacts on water use to accommodate these species, and this only affected a Federal entity on Federal lands (Fort Huachuca).[52] Nonetheless, due to the intense competition for water resources in the Southwest, there is concern that spikedace and loach minnow will need to be considered as "water users" in a water system for which water is already fully allocated. Given data and model limitations, the analysis is not able to answer the question of whether impacts to water users are likely (i.e., the probability of such impacts). It does, however, provide information on the potential scale of the economic impacts that could occur if requirements associated with spikedace and loach minnow conservation result in changes in water diversions or conveyance.[53] Detailed information by river segment is presented below, then summarized in Exhibits 3-6 to 3-8.

3.5.1 COMPLEX 1: VERDE RIVER COMPLEX

90. As shown in Exhibit 3-8 and as discussed in Section 7 of this report, the Verde River segment has the largest number of domestic wells (322), the largest population within 10 miles (58,000), and the largest projected population growth of all proposed CHD areas (49 percent between 2005 and 2025). The proposed segment of the Verde River has perennial flow of approximately 25 to 30 cfs (average flow),[54] which flows through the communities of Camp Verde, Middle Verde, Bridgeport, Cottonwood, and Clarkdale. Most of the surface water rights to the water in the Verde are held by the SRP, which impounds water downstream of the proposed stream segment for water delivery purposes. The only significant upstream impoundment is Sullivan Dam, a heavily silted dam that serves little current use. Other surface water rights are primarily held by irrigators, who divert water for agricultural purposes. Some surface water rights are held by mining interests (Phelps Dodge), though they are not currently used for mining activities (mining activities are detailed in Chapter 5). Residential and commercial users in this area rely on groundwater supplies, either through private or municipal supplies.[55]

91. The relatively large number of groundwater wells (322) that appear to fall in proposed CHD on the Verde River represent 63 percent of all groundwater wells that fall in proposed CHD. Of these wells, most (79 percent) are small wells that are used for domestic purposes.[56] Thirty-three wells that pump greater than 35 gpm fall in proposed

[52] Section 7 regarding Fort Huachuca (02-21-02-F-229; 02-21-98-F-266). This consultation addressed the following listed species: Huachuca water umbel, southwestern willow flycatcher, Mexican spotted owl, lesser long-nosed bat, Sonora tiger salamander, spikedace, loach minnow, bald eagle, jaguar, and Canelo Hills ladies' tresses.

[53] See previous footnote.

[54] Personal communication with J. Rasmussen, Yavapai County Board of Supervisors, Yavapai County Water Advisory Board, February 7, 2006.

[55] Estimated Use of Water in the United States, County-Level Data for 2000, USGS, Freshwater Use estimates. Accessed at http://water.usgs.gov/watuse/data/2000/; Personal communication with J. Rasmussen, Yavapai County Board of Supervisors, Yavapai County Water Advisory Board, February 7, 2006.

[56] Wells pumping less than 35 gpm would be exempt from reporting requirements if they occur in an Active Management Area (AMA). Outside of AMAs, there are no reporting requirements for groundwater wells. Personal communication with W. Werner, Arizona Department of Water Resources, March 22, 2006.

CHD on the Verde, of which 14 are designated for domestic use and 17 are designated for irrigation use.

92. Economies in these communities have traditionally been agricultural, but residential populations have grown quickly in recent years, and continued growth is expected in the near future.[57] The City of Camp Verde has two wells that pump greater than 35 gpm which appear to fall in proposed CHD. A large number of small, residential groundwater wells exist within proposed CHD as well as 17 wells that pump greater than 35 gpm that are used for domestic water use.

93. Approximately 4,800 acres of land are irrigated for crop agriculture in the Verde Valley area, of which most is grown for alfalfa or other forage. These acres represent 47 percent of cropland acres in Yavapai County.[58] At least nine ditch companies utilize Verde surface water.[59] Approximately 500 acres of irrigated lands occur within proposed CHD for the spikedace and loach minnow.[60] As stated above, 17 groundwater wells that pump greater than 35 gpm also fall in proposed CHD. The estimated value of agricultural land that falls in proposed CHD is $3.1 million. The estimated value of agricultural lands within the Verde Valley area, which relies heavily on water diverted from the Verde River is $30.3 million.[61] Approximately $578,000 in NRCS funding was allocated to farms in proposed CHD areas on the Verde River in 2005.[62]

Salt River Project

94. The SRP operates six reservoirs and dams on the Salt and Verde Rivers. Together, these reservoirs provide 40 percent of the water supply to the Phoenix Active Management Area, an area of approximately 5,600 square miles.[63] SRP diverts about 900,000 acre-feet of surface water annually for use by the City of Phoenix, Salt River Pima-Maricopa Indian Community, Fort McDowell Yavapai Nation, Phelps Dodge Corporation (PDC), irrigation users, and other communities in the Phoenix area, including Chandler, Glendale, Mesa, Scottsdale, and Tempe. The system serves 240,000 acres over an area of 375 square miles. While no SRP facilities fall in proposed CHD areas, SRP has water

[57] Verde River Watershed Study, Arizona Department of Water Resources, 2000.

[58] NASS, 2002 Census of Agriculture. "Table 10. Irrigation: 2002 and 1997."

[59] These ditches include: OK Ditch, Eureka Ditch, Diamond Ditch, Pioneer Ditch, Wingfield Ditch, Woods (Verde) Ditch, Jordan Ditch, Cottonwood Ditch, Hickey Ditch. Source: Natural Resource Conservation District, Maps of Irrigated lands of the Cottonwood-Clarkdale Area, and Irrigated Lands of the Camp Verde Area, accessed at www.verde.org, Januray 31, 2006.

[60] Arizona State Lands Department, GIS data CD, 2002, "irrigation.shp"

[61] Reported irrigated cropland values compared with pastureland values. USDA NASS, Agricultural Land Values and Cash Rents, 2005; Accessed at http://www.usda.gov/nass/aggraphs/landcash.htm on Feb 1, 2006.

[62] The percentage of county irrigated land that is likely to use water from proposed CHD areas was estimated assuming NRCS funds are distributed evenly across irrigated lands in counties. NASS 2002: Irrigated land in county. Personal communication with Eric Banks, NRCS, Arizona, February 6, 2006; Personal communication with Mike Neubeiser, NRCS, New Mexico, February 2, 2006.

[63] Final Environmental Impact Statement for the Roosevelt Habitat Conservation Plan, Gila And Maricopa Counties, Arizona Volume 1 of the FEIS. Service, 2002. p 15

rights to a large portion of the flow of the Verde River, and is currently engaged in developing a HCP in the Verde River Watershed for Horseshoe and Bartlett Reservoirs, which are located downstream of proposed CHD for the spikedace and loach minnow. As stated above, the HCP covers many species, including ten native fish species. SRP estimates that the costs of the Horseshoe/Bartlett HCP associated with protections for the ten native fish species will be $3.3 million over the next 50 years ($2005), and will include[64]:

- Capital costs for fish hatchery improvements: $500,000
- Habitat protection, management, restoration, and maintenance: $1,400,000
- Survey and monitoring: $670,000
- Adaptive management and contingency: $720,000

SRP anticipates that approximately 10 percent of these costs will specifically be attributable to spikedace and loach minnow conservation efforts, or $330,000 over 50 years. In addition, SRP estimates that approximately $2,800 annually would be spent on spikedace and loach minnow as part of watershed management and improvement efforts.[65]

City of Prescott

95. The City is located in the Prescott Active Management Area, where water is scarce. For this reason, the City of Prescott recently purchased a ranch that lies 40 to 50 miles north of the City in the vicinity of the Verde River headwaters, which are located upstream of proposed CHD. The City plans to utilize the groundwater water rights it obtained by purchasing this ranch to supply the City with approximately 10,000 to 12,000 acre-feet of water annually for domestic use. The City plans to develop a pipeline system in the next several years in order to deliver the water to its residents.[66]

96. It is possible that the City of Prescott's ability to make use of its existing groundwater resource at JWK Ranch could be limited as a result of spikedace and loach minnow conservation measures, should the ranch be shown to draw water from the Verde River headwaters and thus to adversely affect flow in proposed CHD areas. However, a clear Federal nexus does not exist for this project. The City believes that a hydrologic connection between the ranch and the proposed CHD areas does not exist, but is concerned that intervenors could attempt to show a connection.[67] A recent USGS report on the Big Chino Aquifer (in which the JWK ranch is likely to fall), also finds that the aquifer provides 80 to 86 percent of the base flow to the Upper Verde River at the

[64] Written communication with C. Sommers, ERO Resources, " Re: Critical Habitat Economic Analysis, Spikedace and Loach Minnow," February 2, 2005.

[65] Ibid.

[66] Personal communication with N. James, Fennemore Craig, Attorney for City of Prescott, February 2, 2006.

[67] Personal communication with N. James, Fennemore Craig, Attorney for City of Prescott, February 2, 2006.

Paulden gauge (northern portion of proposed CHD).[68] In a worst case scenario, the Service could recommend, or the City could decide, that in order to prevent take of spikedace and loach minnow, the City must abandon the ranch project, resulting in a loss of the City's ability to use water from the ranch. Under this scenario, the City would lose some of its investment in the ranch, and be forced to seek another, likely more remote and costly water source for its residents. While this scenario appears unlikely, this analysis presents information on this scenario in order to document potential impacts. The impact can be viewed in terms of a lost capital investment; the loss of a reliable, high-quality water supply; and a constraint on the City's ability to flexibly and effectively manage regional water supply and demand.

3.5.2 COMPLEX 2: BLACK RIVER COMPLEX

97. The Proposed Rule lists water diversions as a threat to the East Fork White River. This river segment is within the boundaries of lands owned by the White Mountain Apache Tribe and has been proposed for exclusion. A detailed discussion of potential impacts to Tribal interests is presented in Chapter 8 of this report, and are not included in this chapter.

3.5.3 COMPLEX 3: MIDDLE GILA/LOWER SAN PEDRO/ARAVAIPA CREEK COMPLEX

98. Complex 3 of proposed CHD is principally comprised of three river segments: Aravaipa Creek (28.1 miles), Lower San Pedro (13.4 miles), and the Gila River (39 miles). The downstream terminus of proposed CHD is at Ashurst-Hayden Dam on the Gila River. Approximately 30 miles upstream of proposed CHD on the Gila River is Coolidge Dam. The Proposed Rule lists water diversions as threats to all of these river segments.

99. Approximately 135 acres of lands used for cropland irrigation are located within Complex 3, and 1,220 acres are located in the valley that contains proposed CHD. The value of croplands in proposed CHD is approximately $11,000, while lands in the vicinity of proposed CHD are valued at approximately $7.5 million.[69] Approximately $15,000 in NRCS funding was allocated to farms in proposed CHD areas on these segments in 2005.[70]

100. Construction of the Ashurst-Hayden Diversion Dam was completed in 1922. This dam is operated and maintained by the San Carlos Irrigation Project (SCIP), for the purposes of providing irrigation water for the Gila River Indian Community (GRIC) and the San Carlos Irrigation and Drainage District (SCIDD). All of the flows between the Coolidge Dam and the Ashurst-Hayden Diversion Dam are appropriated. Diversions to these

[68] Laurie Wirt, Ed DeWitt, and V.E. Langenheim, eds. United States Geological Survey, "Geologic Framework of Aquifer Units and Ground-Water Flowpaths, Verde River Headwaters, North-Central Arizona," 2005.

[69] Reported irrigated cropland values compared with pastureland values. USDA NASS, Agricultural Land Values and Cash Rents, 2005; Accessed at http://www.usda.gov/nass/aggraphs/landcash.htm on Feb 1, 2006.

[70] The percentage of county irrigated land that is likely to use water from proposed CHD areas was estimated assuming NRCS funds are distributed evenly across irrigated lands in counties. NASS 2002: Irrigated land in county. Personal communication with Eric Banks, NRCS, Arizona, February 6, 2006; Personal communication with Mike Neubeiser, NRCS, New Mexico, February 2, 2006.

entities are regulated under the 1935 Globe Equity 59 Decree, and overseen by the Gila River Water Commissioner. The Gila Water Commissioner is appointed by the US District Court to administer the Globe Equity 59 Decree, which controls use of the waters of the Gila River in the reach from above Virden, NM to its confluence with the Salt River west of Phoenix, AZ. SCIDD provides water to a variety of private landowners and municipalities for irrigation purposes on approximately 50,000 acres, including the communities of the Casa Grande and Florence Valleys.[71] There is ongoing litigation regarding Gila River water rights that could affect future water rights distribution on the Gila River. There is no history of consultation with the Service for the effects of Ashurst-Hayden Diversion Dam operations on the spikedace and loach minnow.

San Carlos Apache

101. As stated above, the USBR consulted with the Service on a proposed water exchange by the San Carlos Apache.[72] The Tribe states that it is entitled to exchange its CAP water to be supplied downstream of Coolidge Dam in the future.[73] The Tribe has a legal right to conduct this exchange, which would serve multiple functions, including maintaining a minimum water level in the Lake to avoid possible fish kills and impacts on recreation and wildlife. The Tribe is concerned that the designation of CHD for the spikedace and loach minnow would further complicate an already complex and lengthy procedure for conducting an exchange.[74] USBR states that this project will be reevaluated before an exchange could occur and a new consultation is likely. This project is further discussed in Chapter 8 of this report.

3.5.4 COMPLEX 4: SAN FRANCISCO/BLUE RIVER COMPLEX

102. The Blue River runs through forest lands and rural inholdings of the Apache-Sitgreaves and Gila National Forests. Surface waters of the San Francisco and Blue Rivers in New Mexico are primarily used for agriculture. Agriculture along the San Francisco consists of irrigated pasture and ranching activities. Approximately four acres of lands used for cropland irrigation are located within the proposed segment of the San Francisco River. The value of these agricultural lands is approximately $11,000.[75] Approximately $400 in NRCS funding was allocated to farms in proposed CHD areas on this segment in 2005.[76]

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[71] Salmon, Riney B. "Comments of San Carlos Irrigation and Drainage District on Proposed Rule Designating Critical Habitat for the Southwestern Willow Flycatcher (69 Fed. Reg. 60706 (October 12, 2004). Salmon, Lewis, and Weldon, P.L.C., May 24, 2005.

[72] The San Carlos Apache Reservation is proposed for exclusion. However, the stretch of the Gila River in Complex 3 is not.

[73] Ibid.

[74] Personal communication with Susan Montgomery, Sparks, Tehan & Riley, Special Counsel to the San Carlos Apache Tribe, February 14, 2006.

[75] Reported irrigated cropland values compared with pastureland values. USDA NASS, Agricultural Land Values and Cash Rents, 2005; Accessed at http://www.usda.gov/nass/aggraphs/landcash.htm on Feb 1, 2006.

[76] The percentage of county irrigated land that is likely to use water from proposed CHD areas was estimated assuming NRCS funds are distributed evenly across irrigated lands in counties. NASS 2002: Irrigated land in county. Personal communication with Eric Banks, NRCS, Arizona, February 6, 2006; Personal communication with Mike Neubeiser, NRCS, New Mexico, February 2, 2006.

3.5.5 COMPLEX 5: UPPER GILA RIVER

103. The Proposed Rule lists water diversions as a threat to this reach. Surface waters of the Gila River in New Mexico are primarily used for agriculture and mining uses. Major cities in Southwestern New Mexico do not rely on surface water for domestic supply purposes.[77] Approximately 188 acres of lands used for cropland irrigation are located within the proposed Upper Gila River, East Fork Gila River, and West Fork Gila River segments. The value of these agricultural lands is approximately $596,000.[78] Approximately $3,200 in NRCS funding was allocated to farms in proposed CHD areas in 2005.[79]

104. In addition to smaller water diversions, discussions have been ongoing since the 1980's about constructing a dam on the Gila River to allow New Mexico to utilize Gila River water as part of the CAP. The 2004 Arizona Water Settlements Act, PL 108-451 (December 2004) states that the Secretary of the Interior shall "offer to contract with water users in the State of New Mexico, with the approval of the Interstate Stream Commission, or with the State of New Mexico through its Interstate Stream Commission, for water from the Gila River, its tributaries and underground water sources in amounts that will permit consumptive use of water in New Mexico of not to exceed an annual average in any period of 10 consecutive years of 14,000 acre-feet, including reservoir evaporation, over and above the consumptive uses provided for by article IV of the decree of the Supreme Court of the United States in Arizona v. California (376 US 340)."

105. One public commenter states that a diversion of 14,000 acre-feet could "significantly impair river function and riparian conditions and threaten native species…"[80] The New Mexico Interstate Stream Commission (NMISC) has entered into a Memorandum of Understanding with the Bureau of Reclamation, the Service, the Southwest New Mexico Water Planning Group and the New Mexico Office of the Governor to create the Gila-San Francisco Coordinating Committee. NMISC states that this group is conducting an initial evaluation of the effects of potential water withdrawals on fish and wildlife resources in these areas. [81] To date, several proposals have been discussed, but none agreed upon. The New Mexico Interstate Stream Commission does state that building a dam on the Gila

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[77] "Fact Sheet: Water Supply," Southwest New Mexico Regional Water Planning. Accessed at: www.cityofdeming.org on January 10, 2006.

[78] Reported irrigated cropland values compared with pastureland values. USDA NASS, Agricultural Land Values and Cash Rents, 2005; Accessed at http://www.usda.gov/nass/aggraphs/landcash.htm on Feb 1, 2006.

[79] The percentage of county irrigated land that is likely to use water from proposed CHD areas was estimated assuming NRCS funds are distributed evenly across irrigated lands in counties. NASS 2002: Irrigated land in county. Personal communication with Eric Banks, NRCS, Arizona, February 6, 2006; Personal communication with Mike Neubeiser, NRCS, New Mexico, February 2, 2006.

[80] Public comments of Allison Siwik, Gila Resources Information Project (GRIP), "Re: Proposal for Critical Habitat Designation for spikedace and loach minnow," July 7, 2006.

[81] Public comments of Tanya Trujillo, General Counsel, New Mexico Interstate Stream Commission, "Re: Comments from the New Mexico Interstate Stream Commission relating to the Critical Habitat Designation for the Spikedace and Loach Minnow; RIN 1018-AU33", July 6, 2006.

River is not foreseeable at this time.[82] Because the future of this project is unknown, potential impacts of spikedace and loach minnow CHD are not estimated.

3.6 SUMMARY OF WATER USE IMPACTS DUE TO SPIKEDACE AND LOACH MINNOW

106. Exhibit 3-6 presents a summary of projected modification costs in proposed CHD areas. These estimates assume that a similar number of future consultations on water diversion repair activities will occur as did in the past, resulting in 20 future actions over the next 20 years. Project modifications are assumed to be equal to those associated with the low-flow gauge installation, or $13,500 per project. Also included are SRP's projected expenditures associated with the spikedace and loach minnow on the Verde River segment ($32,000).

107. Exhibit 3-7 presents an estimate of the value of agricultural croplands within proposed CHD and in the vicinity of proposed CHD. Croplands within proposed CHD are valued at $4.6 million, while croplands in the vicinity of proposed CHD are valued at $38.5 million.

108. Exhibit 3-8 presents the amount of Federal NRCS funding granted in 2005 in counties that contain proposed CHD for spikedace and loach minnow. Estimated funding in proposed CHD is then estimated by allocating an amount of funding proportional to the acres of irrigated lands in the counties and irrigated acres in the vicinity of proposed CHD. The total amount of NRCS funding granted to farmers in proposed CHD areas in the vicinity of proposed CHD is estimated to be $597,000. It should be noted that NRCS staff state that funds not allocated within proposed CHD would likely be reallocated within the state. NRCS also questions the assumption that farmers would refuse funding to avoid a Federal nexus, particularly as its awards typically go to farmers who wish to promote conservation.

EXHIBIT 3-6. SUMMARY OF PROJECTED PROJECT MODIFICATION COSTS IN PROPOSED CHD AREAS

COMPLEX	RIVER S SEGMENT	NUMBER OF FUTURE CONSULTATIONS	FUTURE (UNDISCOUNTED DOLLARS)	FUTURE PRESENT VALUE 3%	FUTURE PRESENT VALUE 7%
Complex 1	Verde River	6	$ 120,000	$ 90,000	$ 64,000
Complex 3	Aravaipa Creek	1.5	$ 20,000	$ 15,000	$ 11,000
	Gila River	3	$ 41,000	$ 30,000	$ 21,000
Complex 4	Eagle Creek	3	$ 41,000	$ 30,000	$ 21,000
	Blue River	6	$ 81,000	$ 60,000	$ 43,000
Total		**19.5**	**$ 303,000**	**$ 225,000**	**$ 160,000**

Note: Costs Per project are assumed to be $13,500. Verde River segment costs also include projected expenditures by SRP.

[82] Personal communication with Peter Wilkinson, New Mexico Interstate Stream Commission, February 3, 2006.

EXHIBIT 3-7. VALUE OF AGRICULTURAL CROPS WITHIN AND IN THE VICINITY OF CHD (2005$)

COMPLEX	RIVER SEGMENT	CROP ACRES IN CHD	IRRIGATED ACRES IN VICINITY OF CHD [1]	VALUE OF CROPLANDS PER ACRE [2]	VALUE OF AGRICULTURAL CROPLANDS IN CHD	TOTAL VALUE OF AGRICULTURAL CROPLANDS IN VICINITY OF CHD
1	Verde River	504	4,895	$6,190	$3,122,000	$30,300,000
3	Aravaipa Creek	71	503	$6,190	$438,000	$3,114,000
	San Pedro River	64	720	$6,190	$394,000	$4,460,000
4	San Francisco River	4	4	$3,175 [2]	$11,000	$11,000
5	East Fork Gila River	1	1	$3,175	$1,800	$1,800
	Upper Gila River	185	185	$3,175	$588,000	$588,000
	West Fork Gila River	2	2	$3,175	$6,600	$6,600
Total		830	6,310		$4,560,000	$38,500,000

[1] Irrigated acres in the vicinity of CHD are estimated from ALRIS and NLCD data of irrigated lands in Arizona and New Mexico. All irrigated lands in the valleys inhabited by CHD were included in estimates. Arizona State Lands Department, GIS data CD, 2002, "irrigation.shp;" National Land Cover Dataset 1992 (NLCD 1992), US Geological Survey. Accessed at http://landcover.usgs.gov/natllandcover.asp January 30, 2006.

2] The irrigated land on the San Francisco occur in New Mexico, and thus New Mexico land values are used. Reported irrigated cropland values compared with pastureland values. USDA NASS, Agricultural Land Values and Cash Rents, 2005; Accessed at http://www.usda.gov/nass/aggraphs/landcash.htm on Feb 1, 2006.

EXHIBIT 3-8. ESTIMATED ANNUAL NRCS FUNDING IN PROPOSED CHD AREAS (2005$)

COMPLEX	RIVER SEGMENT	COUNTY	IRRIGATED LAND IN COUNTY (ACRES)	NRCS FUNDING IN COUNTY	IRRIGATED ACRES IN VICINITY OF CHD	PERCENT AFFECTED BY CHD [1]	ESIMATED NRCS FUNDING IN VICINITY CHD
1	Verde River	Yavapai	10,304	$1,217,139	4,895	47.5%	$578,218
3	Aravaipa Creek	Pinal	216,886	$2,707,689	503	0.2%	$6,281
	San Pedro River	Pinal	216,886	$2,707,689	720	0.3%	$8,993
4	San Francisco River	Catron	2,442	$280,101	4	0.1%	$404
5	East Fork Gila River	Grant	4,208	$310,203	1	0.0%	$41
	Upper Gila River	Hidalgo/Grant	11,060	$191,435	185	1.7%	$3,204
	West Fork Gila River	Catron	2,442	$280,101	2	0.1%	$238
Total			**464,228**	**$7,694,357**	**6,310**		**$597,378**

[1] "Percent affected by CHD" represents the percentage of county irrigated land that is likely to use water from proposed CHD areas.

Sources: NASS, 2002 Census of Agriculture. "Table 10. Irrigation: 2002 and 1997;" GIS data layer of proposed CHD developed by the Service, Southwest Regional Office, December 2005. Personal communication with Eric Banks, NRCS, Arizona, February 6, 2006; Personal communication with Mike Neubeiser, NRCS, New Mexico, February 2, 2006.

CHAPTER 4 | POTENTIAL ECONOMIC IMPACTS TO LIVESTOCK GRAZING ACTIVITIES

109. This section describes the past and expected future economic impacts to livestock grazing activities in areas proposed as critical habitat for the spikedace and loach minnow. Specifically, this analysis estimates direct and indirect economic impacts on grazing due to spikedace and loach minnow conservation activities. This section is divided into three parts. The first provides an overview of grazing in areas proposed for critical habitat and a general description of recommended conservation activities. Next is a description of the methods used to estimate the economic impacts of grazing restrictions implemented to protect the spikedace and loach minnow and their habitat. The final section provides a summary of past and future impacts to grazing, by river reach.

4.1 SUMMARY OF IMPACTS TO GRAZING

110. To date, there have been 32 consultations on spikedace and loach minnow dealing with livestock grazing. In addition, a lawsuit that named the spikedace and loach minnow resulted in a number of riparian exclusions for grazing on USFS lands. Total costs of past riparian exclusions and project modification costs associated with proposed spikedace and loach minnow CHD areas are estimated to be $467,000 to $3.9 million ($2005, see Exhibit 4-1).

EXHIBIT 4-1. SUMMARY OF PAST COSTS BY REACH, 1986-2005

COMPLEX	REACH	VALUE OF LOST GRAZING ($2005)	COST OF FENCING LOW ($2005)	COST OF FENCING HIGH ($2005)	TOTAL LOW	TOTAL HIGH
1	Verde River	$18,000	$90,400	$903,700	**$108,400**	**$921,700**
	Boneyard Creek	$0	$2,200	$21,700	**$2,200**	**$21,700**
	East Fork Black River	$2,600	$8,200	$81,800	**$10,700**	**$84,400**
2	North East Fork Black River	$6,500	$16,800	$167,800	**$23,300**	**$174,300**
	Aravaipa Creek	$100	$16,300	$163,300	**$16,400**	**$163,300**
	Deer Creek	$0	$400	$3,900	**$400**	**$3,900**
	Gila River	$1,800	$10,700	$107,400	**$12,500**	**$109,200**
3	Turkey Creek	$0	$4,000	$40,300	**$4,000**	**$40,300**
	Blue River	$1,500	$8,600	$85,900	**$10,100**	**$87,400**
	Campbell Blue Creek	$600	$10,200	$101,500	**$10,800**	**$102,100**
	Dry Blue Creek	$700	$4,400	$44,300	**$5,100**	**$44,900**
	Eagle Creek	$20,700	$6,900	$68,600	**$27,500**	**$89,300**
	Frieborn Creek	$200	$1,600	$16,500	**$1,900**	**$16,700**
	Negrito Creek	$1,000	$4,900	$49,000	**$5,900**	**$50,000**
	Pace Creek	$200	$1,200	$11,600	**$1,300**	**$11,800**
	San Francisco River	$23,900	$51,300	$512,800	**$75,100**	**$536,700**
4	Tularosa River	$1,400	$11,100	$111,300	**$12,600**	**$112,800**
	East Fork Gila River	$400	$31,000	$310,100	**$31,400**	**$310,500**
	Middle Fork Gila River	$0	$11,700	$117,000	**$11,700**	**$117,000**
	Upper Gila	$9,200	$85,500	$855,200	**$94,700**	**$864,400**
5	West Fork Gila River	$100	$1,300	$12,700	**$1,300**	**$12,800**
	Total	**$88,700**	**$378,700**	**$3,786,500**	**$467,400**	**$3,875,300**

Source: IEc Analysis. See Appendix C, Exhibit C-1.
Note: Totals may not sum due to rounding.

111. Future costs associated with spikedace and loach minnow conservation activities are anticipated to primarily include costs associated with riparian fence construction and maintenance. Fencing is anticipated to be needed on both sides of streams for all potentially grazed areas in proposed CHD and is assumed to be maintained for 20 years. For stream reaches where riparian fencing is known to exist currently, this analysis attributes the costs of future fence maintenance to spikedace and loach minnow conservation. The Service points out that in some cases, alternative management scenarios, such as seasonal rest combined with grazing rotation, can serve to reduce impacts to spikedace and loach minnow and reduce the need for additional riparian fencing.[83] To be conservative, this analysis assumes that landowners will implement the more costly measures of installing and maintaining riparian fencing. This assumption may result in an overestimate of future costs for some reaches.

112. This analysis also includes estimates of administrative costs of conducting consultations. Administrative costs are discussed in Appendix A. Reductions in grazing effort on Federal lands (i.e., reduced permitted or authorized animal-unit months) are estimated as part of past cost estimates because grazing has already been excluded from the riparian corridor in most CHD reaches. Over 20 years, costs related to grazing conservation activities are estimated to range from $313,000 to $7.4 million (2005$, 7 percent discount rate), as shown in Exhibit 4-2.

[83] Written communication with Service, Arizona Ecological Services Office, July 1, 2005. In public comments, private ranchers have suggested that current management has been successful at mitigating the negative effects of grazing on spikedace and loach minnow habitat and that further limitation of grazing would create conditions conducive to non-native species. Some commenters have also suggested that fencing may actually be detrimental to the species. Public comments of David Ogilvie, Feb. 20, 2006; Public comments of Dennis Parker on behalf of George Yard, Jan. 31, 2006; Public comments of Richard Searle, Coalition of Arizona/New Mexico Counties for Stable Economic Growth, "President," July 6, 2006.

EXHIBIT 4-2. TOTAL FUTURE COSTS BY REACH

COMPLEX	REACH	ANNUAL FUTURE COSTS (UNDISCOUNTED)		TOTAL FUTURE COSTS (UNDISCOUNTED)		TOTAL FUTURE COSTS (PRESENT VALUE 3%)		TOTAL FUTURE COSTS (PRESENT VALUE 7%)	
		LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH
1	Verde River	$6,600	$156,600	$132,500	$3,132,700	$98,600	$2,330,400	$70,200	$1,659,400
	Boneyard Creek	$200	$3,800	$3,200	$75,100	$2,400	$55,900	$1,700	$39,800
	East Fork Black River	$600	$14,200	$12,000	$283,700	$8,900	$211,100	$6,400	$150,300
2	North East Fork Black River	$1,200	$29,100	$24,600	$581,800	$18,300	$432,800	$13,000	$308,200
	Aravaipa Creek	$1,200	$28,500	$24,500	$571,200	$17,900	$423,800	$12,800	$301,800
	Deer Creek	$200	$5,900	$8,900	$148,600	$3,700	$87,500	$2,600	$62,300
	Gila River	$2,100	$49,700	$60,700	$1,174,300	$31,300	$739,600	$22,300	$526,600
3	Turkey Creek	$300	$7,000	$5,900	$139,800	$4,400	$104,000	$3,100	$74,100
	Blue River	$600	$14,900	$12,600	$297,800	$9,400	$221,500	$6,700	$157,800
	Campbell Blue Creek	$700	$17,600	$14,900	$351,900	$11,100	$261,800	$7,900	$186,400
	Dry Blue Creek	$300	$7,700	$6,500	$153,400	$4,800	$114,100	$3,400	$81,300
	Eagle Creek	$500	$11,900	$10,100	$237,800	$7,500	$176,900	$5,300	$126,000
	Frieborn Creek	$100	$2,900	$2,400	$57,200	$1,800	$42,500	$1,300	$30,300
	Negrito Creek	$400	$8,500	$7,200	$169,900	$5,300	$126,400	$3,800	$90,000
	Pace Creek	$100	$2,000	$1,700	$40,200	$1,300	$29,900	$900	$21,300
	San Francisco River	$4,000	$95,100	$117,700	$1,940,300	$59,500	$1,415,200	$42,400	$1,007,800
4	Tularosa River	$800	$19,300	$16,300	$386,000	$12,100	$287,100	$8,700	$204,500
	East Fork Gila River	$2,300	$53,800	$45,500	$1,075,100	$33,800	$799,700	$24,100	$569,500
	Middle Fork Gila River	$900	$20,300	$17,200	$405,500	$12,800	$301,600	$9,100	$214,800
	Upper Gila	$6,300	$148,200	$125,400	$2,964,800	$93,300	$2,205,400	$66,400	$1,570,400
5	West Fork Gila River	$100	$2,200	$1,900	$44,000	$1,400	$32,700	$1,000	$23,300
	Total	**$29,500**	**$699,000**	**$651,700**	**$14,231,100**	**$439,600**	**$10,400,100**	**$313,000**	**$7,405,700**

Source: IEc Analysis. See Appendix C, Exhibit C-2.
Note: Totals may not sum due to rounding.

EXHIBIT 4-3. PROJECT MODIFICATIONS FROM PAST CONSULTATIONS ON SPIKEDACE AND LOACH MINNOW

Changes in Utilization Rates and Other Limitations on Usage

- Severe grazing use (>70%) in any key area in any year shall result in notification to the Service within 30 days and a change in management (a)
- For the Fossil Creek Allotment, which currently has a maximum utilization level of 60 to 70 percent, establish a utilization level of 35-40 percent in key areas. (b)
- For the Apache Maid, Beaver Creek Hackberry/Pivot Rock, and Windmill Allotments, which currently have maximum utilization levels of 50 percent, establish utilization levels of 35-40 percent in key areas (b)
- All reasonable efforts will be made to exclude livestock from the riparian corridor (c)

Maintain Off-River Water Vessels

- In the Thirteen-Mile Rock Allotment, Heifer Pasture, explore options for providing water sources other than the three water gaps currently located within critical habitat on West Clear Creek. If earthen tanks are used, they should be located outside of the 100-year floodplain. (b)
- The Bureau should evaluate stock tanks in the San Pedro River watershed that are within 5 miles of the river for risk of nonnative fish introductions (d)

Create/Maintain Livestock Exclosures

- In year one of the permit, establish key areas and grazing enclosures of 50 feet by 50 feet within each pasture. A minimum of two key areas and two exclosures per pasture should be developed. Key areas should be located on those portions of the range which serve as an indicative example of range conditions, trend, or degree of seasonal use, and shall not include those areas remote from waters, steep slopes, or with poor accessibility as they are not representative of areas used by cattle (a)
- Check and repair as necessary all fences required to maintain the exclusion of livestock from the tributaries of the East Fork of the Black River (e)

Conduct Surveys and Monitoring

- Annual reports detailing measurements taken, methods used, and results of the quantitative measurements shall be made to the Service (a)
- Monitor forage utilization on pastures within all allotments within three weeks after livestock exit each pasture (a, f)
- Monitor forage utilization (b, e, g)
- Establish permanent photopoints to document stream channel condition and trend, and at the same sites, establish cross-channel transects to monitor condition and trend for stream channel morphology (e)

Sources:

(a) "Reauthorization of grazing on the Pleasant Valley Allotment," 02-21-01-F-189

(b) "Possibly effects of on-going grazing activities on eight livestock grazing allotments," 02-22-99-F-016R, 000089ROR, 02-21-92-F-500R, 02-21-94-F-239R, 02-21-92-F-404R, 02-21-96-F-058R, 02-21-01-F-124R, 02-21-01-F-293, 02-21-01-F-294, 02-21-01-F-295, 02-21-01-F-296

(c) "Land and Resource Management Plans for 11 National Forests," 000087RO

(d) "Reinitiation: Programmatic Biological Opinion for the Safford/Tucson Grazing Program," 02-21-96-F-160R5

(e) "Ongoing Livestock Grazing on Allotments," 00089RO

(f) "Reissuance of Term Grazing permits for six allotments," 02-21-95-F-020R, 02-21-01-F-308, 02-21-01-F-105, 02-21-01-F-309, 02-21-01-F-310

(g) "Grazing on four allotments in Apache-Sitgreaves National Forest," 02-21-00-F-286

4.2 BACKGROUND

113. The Proposed Rule states that "on-going livestock grazing is only a threat to spikedace and loach minnow if not properly managed. Proper management may include the use of fencing, appropriate grazing systems, appropriate seasons of use, and other improvements to allotments such as new water tanks."

114. The Service states that adverse effects of livestock grazing on native fishes of the Southwest are well documented, and that ongoing livestock grazing continues to exert adverse effects on native fish by inhibiting recovery from past overgrazing.[84] Direct grazing effects include trampling or ingesting of spikedace and loach minnow, particularly eggs and larval fish. In addition, streambank chiseling, sloughing, compaction, and collapse can lead to wider and shallower stream channels and increased water temperatures. Other effects of grazing on riparian habitat include increased sedimentation, higher peak flows and channel incisement, lower base flows, changes in riparian vegetation and channel morphology, and loss of nutrients within the stream channel.

115. This section discusses the typical project modifications that have been implemented to provide protection for the spikedace and loach minnow from livestock grazing activities on Federal lands. Exhibit 4-3 presents a list of example project modifications from past consultations on USFS and BLM grazing allotments. Examples of conservation activities implemented on grazing allotments for spikedace and loach minnow protection include:

- Conducting surveys at occupied and/or potential spikedace and loach minnow locations;
- Construction and maintenance of livestock exclosures in riparian areas;
- Monitoring of forage utilization within all allotments within three weeks after livestock exit each pasture

These actions can be grouped into three categories: grazing restrictions, other project modifications, and administrative costs. The following sections provide a discussion of the methodology used to estimate the cost of each of these categories on livestock grazing activities.

4.2.1 AUMS AND PERMIT VALUE ON FEDERAL LANDS

116. The greatest economic impact of spikedace and loach minnow conservation on grazing activity occurs when restrictions on the use of riparian areas for livestock grazing are implemented.[85] Exclusion of riparian areas from grazing can result in a reduction in the

[84] Status of Federal and State Listed Warm Water Fishes of the Gila River Basin, with Recommendations for Management. Desert Fishes Team, Report Number 1. October 15, 2003.

[85] Public comments of the New Mexico Cattlegrower's Association (NMCA) point out that ranchers often have debts to repay that rely on the current number of AUMs grazed. NMCA states that even small cuts in the number of AUMs grazed by these ranchers can affect the financial stability of those operations. Public comments of Caren Cowan on behalf of the New Mexico Cattlegrowers' Association, and Mike Corn, New Mexico Wool Growers, Inc, "Re: Reopening of the comment period

number of permitted AUMs (animal unit months: forage for one cow and calf for one month) on the allotment. This section provides a discussion of the methodology used to estimate the economic value of reductions in permitted AUMs.

117. The system of Federal grazing permits in the American West was established on USFS lands in the early 1990s and on BLM lands by the Taylor Grazing Act of 1934.[86] In most areas, qualifying ranches ("base properties") were assigned an exclusive amount of AUMs based on the carrying capacity of the grazing allotment.[87] These allotments were connected to private holdings through the establishment of renewable leases that were both inheritable and transferable with the sale of the land or, in the case of USFS permits, the transfer of the livestock (pending the approval of the USFS or the BLM). As a result of this attachment of the grazing permit to the base properties, real estate markets adjusted the value of those properties to reflect the Federal AUMs associated with the grazing permits, or permit value.[88]

118. This concept of permit value, however, has been an issue of debate. A 1970 court decision, Pankey Land and Cattle Co. v. Hardin, 427 F.2d 43 (10th Cir. 1970), formed the basis for the government's position that ranchers "are not given title to the grazing resource and as such do not own a property right or have a corresponding economic right to permit value."[89] Nonetheless, numerous published studies have found that a rancher obtains a value for holding a Federal grazing permit whether or not he has title to the permit, and whether or not he sells his property.[90] Furthermore, if the grazing fee is below the value of grazing, and if the permit is renewable from year to year in a dependable fashion, then the economic rents (the difference between the fee and the value of grazing) will be incorporated and reflected into the value of the grazing permit.[91]

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on proposed critical habitat for the Southwestern willow flycatcher/July 7, 2005 Federal Register (Volume 70, Number 129), July 18, 2005.

86 Grazing fees on USFS lands was first introduced in 1906. (Cody, B.A. 1996. Grazing Fees: An Overview. Congressional Research Service. Washington, D.C.)

87 Kerr, Andy. 1998. "The Voluntary Retirement Option for Federal Public Land Grazing Permittees. Rangelands." Vol. 20, No. 5. October. 26-30.

88 Stern, B.S. 1998. "Permit Value: A Hidden Key to the Public Land Grazing Dispute." M.S. Thesis. University of Montana. March 1998.

89 Torell et al. "The Market Value of Public Land Forage Implied from Grazing permits." Current issues in Rangeland Economics: 1994. Western Research Coordinating Committee 55: Range Economics, 1994.

90 "The general observation is that public land grazing permits do have market value," Torell et al. "The Lack of Profit motive for ranching: Implications for policy analysis." Current issues in Rangeland Economics, Western Coordinating Committee 55 (WCC-55), 2001. Torell, L. Allen and S.A. Bailey. "Public land policy and the value of grazing permits." Western Journal of Agricultural Economics, Volume 16 (174-184), 1991. Also see Rowan, R.C., and J.P. Workman. "Factors affecting Utah ranch prices." Journal of Range Management. Volume 45 (263-266), 1992. Sunderman, M. A., and R. Spahr. "Valuation of government grazing leases." Journal of Real Estate Research, Volume 9 (179-196), 1992. Spahr, R. and M.A. Sunderman. "Additional evidence on the homogeneity of the value of government grazing leases and changing attributes for ranch value." Journal of Real Estate Research, Volume 10 (601-616), 1995. Torell, L. Allen and M.E. Kincaid. "Public land policy and the market value of New Mexico ranches, 1979-1994." Journal of Range Management, Volume 49 (270-276), 1996.

91 Technical advisor review comments of B. Delworth Gardner, Brigham Young University, December 18, 2005.

119. Thus, permit value can be used as a measure of rancher wealth tied up in grazing permits and forced reductions in permitted AUMs can be represented by a loss in permit value, or rancher wealth (regional livestock production loss and regional economic impacts are discussed later in this section).

120. Numerous publications support this concept of permit value. For example, Torell et al., states that "permit value represents the only available direct valuation of public land forage, except for a few scattered instances where public land is competitively leased. Using an appropriate capitalization rate, annualized estimates of forage value can be determined from the observed permit value."[92] In a summary of recommended forage valuation methods, the author states that "permit values provide a direct and site-specific estimate of forage value. Theoretically, this estimate should provide a site-specific estimate of value while considering the inherent production characteristics, regulations, and economic potential of specific allotments."[93] As defined in a public comment from the New Mexico Department of Agriculture, "permit value is essentially a measure of rancher wealth based on the number of federally permitted AUMs he is allowed to graze, the value of the Federal grazing fee, and the private property rights owned by the permittee."[94] Exhibit 4-4 presents the results of nine recent studies that attempt to measure the permit value, in perpetuity, of Federal grazing (per AUM), by permitting agency (USFS and BLM).

121. The range of values found in these studies likely results from variations in factors, such as study method, region, quality of forage, substitute availability, and capitalization rates. This analysis adopts an estimated permit value, in perpetuity, per AUM as the average of the permit value studies above, or $89 per BLM AUM and $81 per USFS AUM.

[92] Torell et al. "The Lack of Profit motive for ranching: Implications for policy analysis." Current issues in Rangeland Economics, Western Coordinating Committee 55 (WCC-55), 2001.

[93] Torell, L. Allen et al. "Theoretical Justification and Limitations of Alternative Methods used to value public land forage." 1994. Western Research Coordinating Committee 55: Range Economics, 1994.

[94] Private property referred to here reflect private land values. Public comment on Draft Economic Analysis of Critical Habitat for the MSO from Julie Maitland, Division Director, New Mexico Department of Agriculture, April 26, 2004.

EXHIBIT 4-4. SUMMARY OF RELEVANT PERMIT VALUE ESTIMATES FOR BLM AND USFS PERMITS

STUDY	METHOD	YEARS	LOCATION	$/BLMAUM (2005$)*	$/FSAUM (2005$)*
Rowen & Workman	Regression	1975-1987	Utah	$32	$32
Torell & Doll	Regression	1979-1988	New Mexico	$98	$98
Rowen & Workman	Regression	1980-1988	Utah	$61	$61
Torell & Kincaid	Various	1988	New Mexico	$108	$101
Torell et al.	Regression	1992	New Mexico	$111	$90
Kincaid	Regression	1987-1994	New Mexico	$102	$99
Torell & Kincaid	Various	1994	New Mexico	$104	$72
Torell et al.	Case studies	2002	Idaho, Nevada, Oregon	$96	$96
Average				**$89**	**$81**

* Numbers represent the permit value per AUM in perpetuity. Values adjusted to 2005$ using the GDP Deflator, Budget of the United States Government, Fiscal Year 2005, Historical Tables. Sources: Stern, Bill S. "Permit Value: A Hidden Key to the Public Lands Grazing Dispute," University of Montana, Master of Science thesis, 1998; Torell et al., "Ranch level impacts of changing grazing policies on BLM land to protect the Greater Sage-Grouse: Evidence from Idaho, Nevada, and Oregon." Policy Analysis Center for Western Public Lands, Policy Paper SGB01B02, 2002.

4.2.2 FACTORS AFFECTING PERMITTED AND AUTHORIZED AUMS

122. On a particular allotment containing spikedace and loach minnow habitat, reductions to authorized or permitted AUMs made by USFS or BLM may have been: (1) directly related to spikedace and loach minnow conservation; (2) not related to spikedace and loach minnow conservation at all; or (3) a combination of factors. These scenarios are described below:

1. *Causes directly related to spikedace and loach minnow.* Action agencies have had to consider potential impacts of livestock grazing actions on spikedace and loach minnow in habitat areas since its listing. In a 2001 hearing with the New Mexico Public Land Grazing Task Force (New Mexico Task Force), Federal agencies in New Mexico cited compliance with Federal laws as a key factor that affects their management of livestock grazing.[95] As part of a survey, the New Mexico Task Force asked USFS and BLM permittees whether decreases in the permitted number of livestock on their allotments were due to the presence of federally listed endangered or threatened species. Their answers indicate that

[95] "Report to the Governor of New Mexico from the Public Land Grazing Task Force," prepared by George A. Douds, New Mexico Department of Agriculture, 2002. The Task Force sent surveys to 1,128 USFS permittees and 2,045 BLM permittees. They received responses from 322 USFS and 482 BLM permittees, or 29 and 24 percent, respectively.

endangered species considerations have influenced the number of permitted AUMs, particularly on National Forest lands.[96] For example, on the Gila National Forest, 42 percent of respondents claimed that their allotments had reductions in AUMs resulting from endangered species presence. Although not definitive, this survey supports the assertion that spikedace and loach minnow considerations may affect the number of permitted AUMs on allotments.

2. *Causes unrelated to spikedace and loach minnow.* When Federal agencies assess an allotment for permit renewal, they must also consider weather conditions (drought), forage availability, presence of other ungulates, such as elk, as well as presence of other sensitive, threatened and endangered species. For example, in the Tonto, Coconino, and Prescott National Forests, recent reductions in AUMs have been prompted by drought.

3. *Combination of Causes.* In most cases, decisions by Federal agencies to change the permitted or authorized AUMs in spikedace and loach minnow habitat areas is a combination of considerations that include the spikedace and loach minnow, other endangered species, other regulatory considerations (such as Grazing Guidance Criteria, Forest Plans, and Resource Management Plans), current forage availability, general health of the riparian corridor, and weather conditions. In addition, subjective factors such as political pressures from interest groups or other land user groups may also influence agency decisions. These subjective impacts are the most difficult to predict, but may play an important role in the decisionmaking process.

For allotments that have gone through formal section 7 consultations, or the NEPA permit issuance processes, specific changes directly caused by the spikedace and loach minnow can be described and documented. However, not all changes to the permitted AUMs may be directly attributable to spikedace and loach minnow conservation activities.

4.2.2.1 Avoiding AUM Reductions

123. According to USFS and BLM staff, range managers can sometimes avoid AUM reductions when grazing restrictions are put in place for spikedace and loach minnow through changes in grazing management practices. However, these approaches to management may result in other costs, such as losses in flexibility and increases in the time permittee must commit to livestock management to ensure that cows do not wander into spikedace and loach minnow habitat areas.[97]

[96] While this survey does not present a definitive answer to the question posed, it suggests that AUM reductions may be, in part, associated with endangered species considerations. However, the survey question was not specific to spikedace and loach minnow, thus drawing conclusions from this study about reductions in AUMs that may have resulted from spikedace and loach minnow conservation activities is not possible.

[97] Personal communication, Vicente Ordonez, Apache-Sitgreaves National Forest, August 13, 2004; Personal communication, Ralph Pope, Gila National Forest, August 27, 2004.

4.2.2.2 Estimating Spikedace and Loach Minnow-related AUM Reductions associated with Public Lands Grazing

124. This analysis identifies costs related to spikedace and loach minnow conservation according to the following criteria:

1. For Federally leased allotments identified by wildlife biologists, range managers, and permittees as being impacted or potentially impacted by actions directly related to spikedace and loach protection, this analysis utilizes the AUM reductions estimated by these entities;
2. For allotments where the number of AUM reductions directly related to spikedace and loach minnow protection is not known, this analysis assumes the reduction in AUMs due to spikedace and loach minnow is proportional to the percentage of the allotment designated as proposed spikedace and loach minnow critical habitat.
3. For allotments where the number of AUMs in an allotment is unavailable, this analysis calculates the reduction in AUMs due to spikedace and loach minnow by multiplying the average number of AUMs per acre (derived from allotments where AUM are available, or 0.06 AUMs per acre), by the number of acres of grazing land in critical habitat.

4.3 PAST COSTS FROM GRAZING

4.3.1 ADMINISTRATIVE COSTS

125. Consultations on livestock grazing have comprised a large segment of past consultations involving spikedace and loach minnow. Of 76 past consultations, 32 addressed grazing issues on Federal lands (42 percent of all consultations). Administrative costs associated with past consultations on spikedace and loach minnow are estimated to be $820,000 to $2,050,000 (undiscounted dollars). Details of these estimates are provided in Appendix A.

4.3.2 PREVIOUS REDUCTIONS IN GRAZING EFFORT

126. The greatest past economic impact of spikedace and loach minnow conservation on livestock grazing activities has occurred when restrictions on the use of riparian areas for livestock grazing were implemented and reductions in the level of grazing activity have occurred. On Federal lands, AUM reductions take the form of reductions in the number of authorized or permitted AUMs by USFS for BLM range members. On many allotments that contain spikedace and loach minnow habitat, riparian areas have already been excluded from grazing either year-round or seasonally (see Exhibit 4-3).

127. In 1998, USFS Region 3 (New Mexico and Arizona) conducted a region-wide consultation on all of their grazing actions, resulting in the allotment-by-allotment review of 963 allotments. This review was the result of two lawsuits filed against the USFS by environmental groups in 1997, the Forest Guardians and the Center for Biological Diversity. The Forest Guardians' initial lawsuit focused upon four endangered species

and threatened species: the southwestern willow flycatcher, the loach minnow, the spikedace, and the Mexican spotted owl (MSO). Their lawsuit challenged the issuance of grazing permits on allotments located in the Apache-Sitgreaves, Carson, Cibola, Gila, Prescott, and Santa Fe National Forests. The Center for Biological Diversity's initial lawsuit did not focus on any specific endangered or threatened species, but challenged the issuance of grazing permits on allotments in six national forests: Apache-Sitgreaves, Coconino, Coronado, Gila, Prescott, and Tonto. Because the complaints shared common issues and challenged many of the same allotments, the cases were consolidated.

128. In response to the lawsuit, USFS initiated informal consultation with the Service in February 1998 on the 158 allotments named in the complaints as well as hundreds of other allotments (962 in total) in the National Forests of Arizona and New Mexico (USFS Region 3). The purpose of the consultation was to determine the potential effects of livestock grazing on endangered and threatened species on the allotments and therefore whether formal consultation between USFS and the Service was necessary. As part of the informal consultation process, the Forest Service also developed "Grazing Guidance Criteria for Preliminary Effects Determinations for Species Listed as Threatened, Endangered or Proposed for Listing," ("Guidance Criteria") dated February 13, 1998.

129. Of the 962 allotments under consultation, 619 "No Effect," 321 "NLAA" (not likely to adversely affect) findings, and 22 "LAA" (likely to adversely affect) determinations were made. "No Effect" findings concluded the Forest Service's obligations under the Act and do not require Service concurrence. The Forest Service received concurrence from the Service for the 321 "NLAA" determinations thus no further action was necessary on those allotments.

130. This left 22 allotments where the Forest Service made LAA determinations with regards to the loach minnow. In February 1999, the Service released a biological opinion in which it concluded that the impacts of grazing on 21 of the 22 allotments would not jeopardize the continued existence of the loach minnow.

131. The 962-allotment review prompted both Plaintiffs to amend their complaints in September 1999. The Forest Guardians narrowed their complaint to the loach minnow, the spikedace, and the MSO on allotments in the Apache-Sitgreaves, Gila and Cibola National Forests while the Center for Biological Diversity re-focused their complaint to the loach minnow and spikedace on allotments in the Apache-Sitgreaves and Gila National Forests.[98] The result of this process was the exclusion of the majority of the riparian corridor on grazing allotments in USFS Region 3.[99]

[98] United States District Court of Arizona. Southwest Center for Biological Diversity, et al., Plaintiff v. United States Forest Service et al., Defendants, and Arizona Cattle Growers' Association, Applicant-in-Intervention. Forest Guardians, Plaintiff v. United States Forest Service, et al., Defendants. No. CV 97-666 TUC JMR consolidated with No. CIV 97-2562 PHX-SMM.

[99] Personal communication, Wally Murphy, USFS Region 3, September 3, 2004.

EXHIBIT 4-5. SUMMARY OF ALLOTMENT STATUS FOR COMPLEX 1

RIVER SEGMENT	RIPARIAN EXCLUSION?	METHOD OF RIPARIAN EXCLUSION	FUTURE CONSERVATION EFFORTS NEEDED
Verde River	Yes, except for the Young allotment (seasonal)	Riparian pastures excluded on seven allotments; fencing installed on one allotment	Fence maintenance
Source: Personal communication with Albert Sillas, Prescott National Forest, Feb. 1, 2006.			

EXHIBIT 4-6. SUMMARY OF ALLOTMENT STATUS FOR COMPLEX 2

RIVER SEGMENT	RIPARIAN EXCLUSION?	METHOD OF RIPARIAN EXCLUSION	FUTURE CONSERVATION EFFORTS NEEDED
East Fork Black River	Yes	Excluded by fence or by pasture exclusion	Fence maintenance
Boneyard Creek	Yes	Excluded by fence or by pasture exclusion	Fence maintenance
North East Fork Black River	Yes	Excluded by fence or by pasture exclusion	Fence maintenance
Source: Personal communication with Bill Wall, Apache-Sitgreaves National Forest, Feb. 17, 2006.			

EXHIBIT 4-7. SUMMARY OF ALLOTMENT STATUS FOR COMPLEX 3

RIVER SEGMENT	RIPARIAN EXCLUSION?	METHOD OF RIPARIAN EXCLUSION	FUTURE CONSERVATION EFFORTS NEEDED
Aravaipa Creek	Yes, except for Hell Hole Allotment	Excluded by fence or pasture exclusion except for Hell Hole Allotment	Fence maintenance, potential AUM reduction and fence construction for Hell Hole Allotment
Gila River	Yes, except for Rafter 6, Kearney, and Adiamond Allotments	Excluded by fence or by pasture exclusion	Fence maintenance, potential AUM reduction and fence construction for currently grazed allotments
Deer Creek	Yes, except for Hell Hole Allotment	Excluded by fence or pasture exclusion except for Hell Hole Allotment	Fence maintenance, potential AUM reduction and fence construction for Hell Hole Allotment
Turkey Creek	Yes	Excluded by fence or by pasture exclusion	Fence maintenance
Source: Written communication with T. Cordery, Arizona BLM, on Mar. 9, 2006.			

EXHIBIT 4-8. SUMMARY OF ALLOTMENT STATUS FOR COMPLEX 4

RIVER SEGMENT	RIPARIAN EXCLUSION?	METHOD OF RIPARIAN EXCLUSION	FUTURE CONSERVATION EFFORTS NEEDED
Eagle Creek	Yes	Excluded by fence or by pasture exclusion	Fence maintenance
San Francisco River	Yes except for Smuggler Peak and Gila Allotments	Fence and natural barrier (Harden Cienaga); Fence except at water points (Kelly); Pasture exclusion (Black Bob)	Fence maintenance, potential AUM reduction and fence construction for allotments currently grazed
Tularosa River	Yes	Excluded by fence except at water points (Eagle Peak)	Fence maintenance
Campbell Blue Creek	Yes	Excluded by fence or by pasture exclusion	Fence maintenance
Blue River	Yes	Excluded by fence or by pasture exclusion	Fence maintenance
Frieborn Creek	Yes	Excluded by fence or by pasture exclusion	Fence maintenance
Pace Creek	Yes	Excluded by fence or by pasture exclusion	Fence maintenance
Negrito Creek	Yes	By fence except at water points (Eagle Peak)	Fence maintenance
Dry Blue Creek	Yes	By fence (Luna)	Fence maintenance
Source: Written communication with Jerry Monzingo, Gila National Forest, on Jan. 20, 2006; personal communication with Bill Wall, Apache-Sitgreaves National Forest, on Feb. 17, 2006; written communication with T. Cordery, Arizona BLM, on Mar. 9, 2006.			

EXHIBIT 4-9. SUMMARY OF ALLOTMENT STATUS FOR COMPLEX 5

RIVER SEGMENT	RIPARIAN EXCLUSION?	METHOD OF RIPARIAN EXCLUSION	FUTURE CONSERVATION EFFORTS NEEDED
Upper Gila	Yes	Excluded by fence or by pasture exclusion (XSX)	Fence maintenance
East Fork Gila	Yes	Excluded by fence; Pasture exclusion (Sapillo)	Fence maintenance
Middle Fork Gila	Yes	Excluded by fence or by pasture exclusion	Fence maintenance
West Fork Gila	Yes	Excluded by fence or by pasture exclusion	Fence maintenance
Source: Written communication with Jerry Monzingo, Gila National Forest, Jan. 20, 2006.			

4.4 FUTURE COSTS TO GRAZING ACTIVITIES

132. As stated above, previous lawsuits have resulted in the exclusion of cattle from much of the riparian corridor in proposed CHD areas. Thus, it is not anticipated that spikedace and loach minnow conservation activities will result in further reductions in permitted or authorized AUMs on Federal lands.[100] Instead, future costs are expected to include maintaining existing riparian fencing as well as constructing riparian fencing in areas not previously fenced and installing off-river water sources. For areas where fencing is known not to exist, or where it could not be determined if adequate fencing exists, fencing is assumed to be needed on both sides of streams for all potentially grazed areas in proposed CHD, and is assumed to be maintained for 20 years. This may result in an overestimate of future costs for some reaches. For areas that are known to already have adequate fencing, the only future cost assumed is the cost of fence maintenance.

133. Costs of fencing exclosures for spikedace and loach minnow are anticipated to range from $1,500 to $15,000 per river mile of fence construction, with an additional $110 to $2,600 annually in maintenance (see Exhibit 4-10). Land managers point out that maintenance of riparian fencing ultimately outweighs the costs of installing it, as animals, weather, water, and human abuse all contribute to fence wear and tear over time.[101] Over 20 years, these costs are estimated to be $651,700 to $14.2 million (undiscounted dollars) and are comprised primarily of fencing maintenance costs. BLM states that the agency usually funds fence construction, while maintenance programs may be shouldered by the permittees.[102] However, staff from Partners for Wildlife state that on private lands, landowners sometimes do not wish to receive Federal assistance for fence construction due to concerns that there may be "strings attached," such as allowing Federal access to their property over time.[103]

134. Costs of conservation activities associated with grazing activities are presented in Exhibit 4-10.

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[100] This past loss of AUMs has been an economic burden on local ranchers, especially when coupled with other natural occurrences such as drought. Public comments of Jim and Clarice Holder, July 6, 2006.

[101] Personal communication with Ted Cordery, BLM, Arizona State Office, July 18, 2005.

[102] Personal communication with Ted Cordery, BLM, Arizona State Office, July 18, 2005.

[103] Service, Partners for Wildlife, Arizona Ecological Services Office, July 15, 2005.

EXHIBIT 4-10. COST ESTIMATES: INSTALLING AND MAINTAINING CATTLE EXCLUSION FENCING AND ALTERNATIVE WATER SOURCES (UNDISCOUNTED 2005$)

ACTION	COST		SOURCE
	LOW	HIGH	
Livestock Fencing (Per Mile)			
Fence Construction*	$1,500	$ 15,000	1 to 5, 8
Fence Maintenance and inspection (annual)	$ 110	$ 2,600	4,6
Total (20 years)	$3,700	$ 66,800	

Note: Numbers may not sum due to rounding.
*Assumed to be a one-time cost over 20 years.
1/ BPA-Fish and Wildlife Program FY99 Proposal: North Fork John Day Area Riparian Fencing: Umatilla National Forest
2/ Project 1991011901-Hungry Horse Fisheries Mitigation-Flathead Lake: Confederated Salish and Kootenai Tribes
3/ Estimated fencing costs of $10,000 per mile from Frank Hayes, Apache-Sitgreaves National Forest District Ranger, October 2002, for fencing installed along East Eagle Creek.
4/ Platts, William S., and Fred. J. Wagstaff., Fencing to Control Livestock Grazing on Riparian Habitats Along Streams: Is It a Viable Alternative? North American Journal of Fisheries Management. Vol. 4, No. 3, pp. 266-272. [doi: 10.1577/1548-8659(1984)4<266:FTCLGO>2.0.CO;2]
5/ Personal Communication with Buck McKinney. Grazing Specialist- U.S. Forest Service. On June 22, 2005.
6/ Wilson/Wall Creek Riparian Fencing Project: Secure Rural Schools and Community Self-determination Act of 2000, Public Law 106-393: Title 2 Project Submission Form, April 13, 2001
7/ Lynch, Loretta and Bob Tjaden. "When a Landowner Adopts a Riparian Buffer-Benefits and Costs." Maryland Cooperative Extension, University of Maryland. http://www.riparianbuffer.umd.edu/PDFS/FS774.pdf
8/Personal communication with Ted Cordery, BLM, Arizona State Office, July 18, 2005.
Note: Costs related to species surveying and monitoring are included under Species Management Costs in Section 8.

CHAPTER 5 | POTENTIAL ECONOMIC IMPACTS TO MINING OPERATIONS

135. This section describes the past and expected future economic impacts to mining activities in areas proposed as critical habitat for the spikedace and loach minnow. This section is divided into three parts. The first provides an overview of the economic importance of the mining industry to the counties containing proposed CHD and to the state of Arizona. Next is a discussion of past economic impacts to mining operations related to spikedace and loach minnow conservation activities. The final section discusses qualitatively the mining operations that may be affected by proposed CHD, including impacts on Phelps Dodge Corporation and its affiliates (PDC) and ASARCO, Inc.

5.1 SUMMARY OF POTENTIAL IMPACTS TO MINING ACTIVITIES

136. While few active mineral mining activities occur within the proposed CHD, the mining industry has expressed concern that water use by existing or potential mining operations could be affected by endangered species conservation activities, particularly the designation of critical habitat. Critical to an understanding of the potential for impacts on water diversions or conveyance is an understanding of the probability and magnitude of any such changes. As detailed in this section, there is currently no data that indicates whether existing or future diversions of water for mining activities (including groundwater use) reduces stream flow or modifies hydrologic conditions to a degree that adversely impacts the spikedace and loach minnow or their habitat. In addition, hydrologic models are unavailable to assess the role of any specific mining facility's groundwater pumping or surface water diversions in determining stream flow or other hydrologic conditions within critical habitat. As such, this analysis does not quantify the probability or extent to which water use for mining purposes would need to be curtailed or modified to remedy impacts on spikedace and loach minnow.

137. Given data and model limitations, this analysis does not answer the question of whether impacts to mining operations are likely (i.e., the probability of such impacts), or define the expected magnitude of these impacts. It does, however, provide information on the potential scale of the economic impact that could occur if requirements associated with spikedace and loach minnow conservation result in changes in water diversions or conveyance. Specifically, to allow for an understanding of the economic activities that could be at risk if modifications to water use or conveyance are required, this analysis provides data on the location of mining activities potentially associated with CHD areas, as well as data on the regional economic importance of these operations.

5.2 POTENTIAL IMPACTS TO MINING OPERATIONS

138. The Proposed Rule specifically identifies mining as a threat for the proposed reaches of San Pedro River and Eagle Creek. Other proposed stream reaches located adjacent to or providing water to mining operations include the Upper Gila River in New Mexico and the Gila River in Arizona. Because certain types of mining activities use considerable volumes of water, spikedace and loach minnow protection measures that require significant modifications in management regimes at dams or in surface or groundwater diversions could impact mining activities that utilize water on these stream reaches.

5.3 OVERVIEW OF MINING ACTIVITIES IN CRITICAL HABITAT AREAS

139. Mining is a large industry in the counties containing spikedace and loach minnow CHD, particularly in the state of Arizona. According to the Department of Mines and Mineral Resources, the estimated value of Arizona's non-fuel mineral production in 2003 was $2.1 billion, an eight percent increase over the 2002 value. In 2003, the value of Arizona's non-fuel mineral production ranked third in the U.S.[104]

140. Copper production makes up the majority of non-fuel mineral production in Arizona. The Arizona Mining Association (AMA) states that Arizona "leads the nation in copper production, accounting for 65 percent of the total U.S. mine production."[105] PDC is the state's largest copper producer, accounting for more than 75 percent of Arizona's total copper production in 2003.[106] The AMA notes that Arizona is also a leader in the production of gemstones, molybdenum, silver, perlite, sand, and gravel. In all, 72 mining companies operated 126 mines in Arizona and employed more than 15,000 people in 2003.[107] Consequently, the mining industry's contribution to Arizona's economy is important, particularly to some rural communities who rely on mining activities to provide employment and tax revenue. In 2004, the combined direct and indirect impacts of the copper industry on Arizona's economy was approximately $3.3 billion,[108] or 1.8 percent of Arizona's 2004 total gross state product.[109]

141. New Mexico is a leading producer of coal, copper, molybdenum, and potash. In 2001, New Mexico produced 309 million pounds of copper valued at $227 million. As a state,

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[104] Arizona Department of Mines and Minerals/U.S. Geological Survey, "The Mineral Industry of Arizona," U.S. Geological Survey Minerals Yearbook, 2003, accessed at minerals.usgs.gov/minerals/pubs/state/az.html.

[105] Arizona Mining Association, Public Comment of Draft EA for Southwestern Willow Flycatcher, submitted on July 18, 2005.

[106] Arizona Department of Mines and Minerals/U.S. Geological Survey, "The Mineral Industry of Arizona," U.S. Geological Survey Minerals Yearbook, 2003, accessed at minerals.usgs.gov/minerals/pubs/state/az.html.

[107] Ibid.

[108] George F. Leaming, Western Economic Analysis Center, "The Economic Impact of the Arizona Copper Industry 2004", May 2005.

[109] U.S. Department of Commerce, Bureau of Economic Analysis. Gross State Product News Release accessed at http://www.bea.gov/bea/newsreel/GSPNewsRelease.htm on September 9, 2005.

New Mexico was the third largest producer of copper in 2000 as well as being the sixth largest producer of molybdenum and the largest producer of potash.[110]

5.4 PAST ECONOMIC IMPACTS ON MINING ACTIVITIES

142. No formal section 7 consultations have directly addressed impacts of mining activities in the areas proposed for CHD. There have, however, been several informal consultations regarding surface mining since the listing of the species. In addition, the Service conducted one formal consultation on spikedace and razorback sucker regarding spillway repair to the Phelps Dodge Diversion dam on Eagle Creek in 1996.[111] This consultation did not directly address impacts of the diversion dam itself, though the Service recommended that such a consultation be conducted. The consultation found that the proposed action was not likely to adversely affect the fish species, and recommended minimizing the use of heavy equipment in the wetted area, making reasonable efforts to ensure no pollutants enter surface water, catch and release of any spikedace found, as well as monitoring activities. Administrative costs associated with these consultations are discussed in Appendix A.

5.5 FUTURE ECONOMIC IMPACTS ON MINING ACTIVITIES

143. The locations of mine and mineral deposits relative to CHD areas were determined using geographic data from the USGS Mineral Resource Data System, and are presented in Exhibit 5-1. Most of these mines and mineral deposits have never been, or are no longer in production. Exhibit 5-2 shows current producers, prospects, and occurrences. These include one active sand and gravel mine located adjacent to the Verde River in Complex 1 and two "expected prospects" located within Gila River proposed CHD in Complex 3 that may be developed in the future. In addition to mining activity that occurs within proposed CHD, several large mining facilities rely on water from proposed CHD for production. These facilities are shown in Exhibit 5-1 and are described in more detail below.

[110] New Mexico Bureau of Geology and Mineral Resources. Minerals production data in New Mexico 1999-2001. Accessed at http://geoinfo.nmt.edu/resources/minerals/documents/table2.pdf on Feb. 17, 2006.

[111] 02-21-96-F-0335

EXHIBIT 5-1. LARGE MINING OPERATIONS ADJACENT TO PROPOSED CHD AREAS

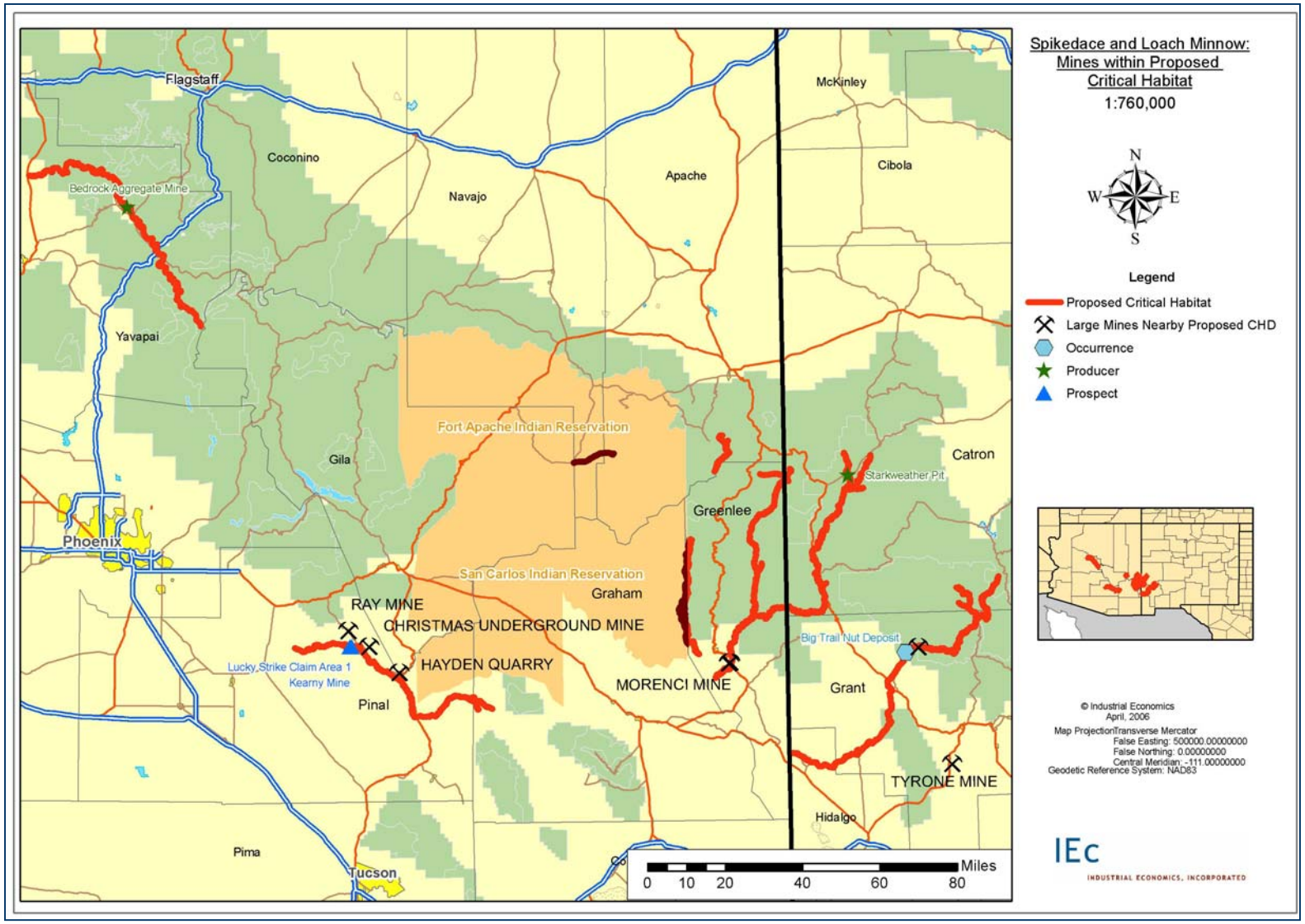

EXHIBIT 5-2. MINERAL RESOURCES LOCATED WITHIN PROPOSED CHD

COMPLEX	STREAM SEGMENT	COUNTY	SITE NAME	TYPE	STATUS
1	Verde River	Yavapai, Arizona	Bedrock Aggregate	Sand and Gravel	Producer
3	Gila River	Pinal, Arizona	Lucky Strike Claim - Area 1	Unknown	Prospect
			Kearny 14	Unknown	Prospect
4	San Francisco River	Greenlee, Arizona	Clifton Hot Springs	Geothermal	Unknown
		Catron, New Mexico	Starkweather Pit	Sand and Gravel	Producer
5	Gila River	Grant, New Mexico	Big Trail Nut Deposit	Fluorine-Fluorite	Occurrence

Notes: The geographic data used for this analysis was extracted in December 2004 by USGS. This database contains the records previously provided in the Mineral Resource Data System of USGS and the Mineral Availability System/Mineral Industry Locator System (MAS/MILS) originated in the U.S. Bureau of Mines, which is now part of USGS.
"Occurrence" status indicates that a mineral deposit exists, yet that no developed mining infrastructure exists on the site. Such status does not imply that any individual or corporation owns rights to the deposit or that any individual or corporation intends to mine the deposit. "Prospect" status indicates that although exploration at a mineral deposit is underway, no production is planned in the near term. "Producer" status indicates that the resource is in active use.
Sources: U.S. Geological Survey, 2005, Mineral Resources Data System: U.S. Geological Survey, Reston, Virginia. Written and personal communication with Nyal Niemuth, Mining Engineer, Arizona Department of Mines and Mineral Resources on September 2, 2005 and September 9, 2005.

5.5.1 POTENTIAL IMPACTS TO PHELPS DODGE CORPORATION

144. According to Fennemore Craig, P.C., "the utility of Phelps Dodge's operations depends on the certainty of available water supplies. It is well known that mining requires the use and availability of dependable water supplies and that such supplies are in limited quantity in the arid southwest. If the availability of water is curtailed or precluded, PDC operations would be severely impacted and their viability placed at risk."[112] The Service notes that this has not happened before under previous designations of critical habitat for these species.[113] PDC is also concerned that some potential ore reserves may not be exploitable if critical habitat for spikedace and loach minnow leads to unavailability of water supplies, large mitigation costs and/or project delays.

[112] Public comments of Norman James, Fennemore Craig, on behalf of Phelps Dodge Company, July 6, 2006.

[113] Written comments of Service, Arizona Ecological Services Office, received Mar. 15, 2006.

145. PDC has identified two operating mines, Morenci and Tyrone, and two non-operating mines, the Christmas mine district and United Verde Mine, for which spikedace and loach minnow impacts may be a concern.[114]

Morenci Mine

146. The Morenci mine is an active open-pit copper mine located in Greenlee County, Arizona. It is located two to three miles from stream segments in Complex 4 of the proposed CHD. Water for the Morenci mine is supplied by a combination of sources, including decreed surface water rights in the San Francisco River, Chase Creek and Eagle Creek drainages, groundwater from the Eagle Creek wellfield, and CAP water leased from the San Carlos Apache Tribe and delivered to Morenci via exchange through the Black River Pump Station. Much of this water is diverted through Eagle Creek (which has been proposed as CHD) on route to the mine.[115] PDC diverts water from the Black River into Willow Creek (a tributary of middle Eagle Creek), augmenting flow in Eagle Creek by about 27 percent. That water plus an additional nine percent is removed about 15 miles downstream at the diversion dam and pumping station.[116]

147. Of PDC's US mines, the Morenci mine has consistently produced the largest volume of copper sold by PDC (420,300 tons in 2004). PDC is concerned that the maintenance of the diversion could act as a Federal nexus for consultation because the diversion is subject to USACE 404 permit requirements. Indeed, as described above, one consultation on repair to the spillway of this diversion has already occurred, and the Service did recommend that a consultation on the diversion itself be conducted.[117]

148. PDC is also concerned that, if CHD affects its ability to utilize its current water supplies, it could be forced to undertake a costly search for replacement supplies.[118] In the case of Morenci, PDC estimates that the combined Eagle Creek and Black River delivery system has provided in excess of 18,000 acre-feet per year for mining operations and for potable uses at the mine itself and the town of Clifton. If PDC had to find alternative sources for

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[114] NERA Economic Consulting, Comments on 'Economic Analysis of Critical Habitat Designation for the Spikedace and Loach Minnow,' prepared by Industrial Economics, Inc. (IEC), July 6, 2006 submitted with public comments by Norman James, Fennemore Craig, on behalf of Phelps Dodge Company, July 6, 2006.

[115] NERA Economic Consulting, Comments on 'Economic Analysis of Critical Habitat Designation for the Spikedace and Loach Minnow,' prepared by Industrial Economics, Inc. (IEC), July 6, 2006 submitted with public comments by Norman James, Fennemore Craig, on behalf of Phelps Dodge Company, July 6, 2006; Personal communication at meeting with Phelps Dodge, Phoenix, Arizona, November, 16, 2005.

[116] 02-21-96-F-0335

[117] Ibid.

[118] According to a NERA report submitted by PDC, "identifying viable supplies involves researching and analyzing information on the availability of water and water rights in areas within piping distance of an affected area. This may involve considerable investigation and negotiation by specialist staff to secure and undertake the transaction." NERA Economic Consulting, Comments on 'Economic Analysis of Critical Habitat Designation for the Spikedace and Loach Minnow,' prepared by Industrial Economics, Inc. (IEC), July 6, 2006 submitted with public comments by Norman James, Fennemore Craig, on behalf of Phelps Dodge Company, July 6, 2006.

18,000 acre-feet at the average cost for water in Arizona of $1,898 per acre-foot, it would cost $34.2 million to replace that 18,000 acre-feet.[119]

149. PDC also leases lands along Eagle Creek north of its water diversion. PDC is concerned that, if CHD causes restrictions on the timing or quantity of surface water withdrawals for irrigating crops or other grazing or agricultural use, the value of leased land could decrease.[120] Potential impacts of CHD on agricultural land values associated with reduced water use is further discussed in Section 3 of this report.

Tyrone Mine

150. The Tyrone mine is an active open-pit copper mine located in Grant County, New Mexico. The Tyrone mine is located 20 miles from the Upper Gila proposed CHD and relies on surface and groundwater supplies for its mining operations. PDC maintains a water diversion from within proposed CHD that leads to an off-river river water storage area called Bill Evans Lake which feeds an underground pipeline to the mine. While the surface water diversion constitutes only a portion of the water used by this mine, the volumes used are significant in that it may be difficult for this operation to access substitute water sources. [121]

151. Under a hypothetical situation in which CHD related restrictions were to prevent PDC from using 7,000 acre-feet per year of Gila River water rights associated with the Tyrone mine, PDC would have to seek alternate sources for those 7,000 acre-feet. Using an average cost for a water right in New Mexico of $4,174 per acre-foot, PDC estimates that replacing this water would cost approximately $29.2 million. PDC notes that replacements costs could, in fact, be higher as this mine located in remote areas where the water costs may be higher.[122] Using five example transactions from 2001, PDC estimates that water prices in the Gila River area could be as much as $6,383 per acre-foot, which would result in costs to replace 7,000 acre-feet of $44.7 million.[123]

152. PDC is also concerned that the maintenance of the diversion could act as a Federal nexus for consultation.

Christmas Mine

153. The Christmas mine district is adjacent to proposed CHD for the spikedace and loach minnow in Complex 3 near the confluence of the San Pedro and Gila Rivers. This mine was taken off-line in 1983 and is currently in a "care and maintenance" phase. There are

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[119] NERA Economic Consulting, Comments on 'Economic Analysis of Critical Habitat Designation for the Spikedace and Loach Minnow,' prepared by Industrial Economics, Inc. (IEC), July 6, 2006 submitted with public comments by Norman James, Fennemore Craig, on behalf of Phelps Dodge Company, July 6, 2006.

[120] ibid.

[121] 02-21-96-F-0335

[122] NERA Economic Consulting, Comments on 'Economic Analysis of Critical Habitat Designation for the Spikedace and Loach Minnow,' prepared by Industrial Economics, Inc. (IEC), July 6, 2006 submitted with public comments by Norman James, Fennemore Craig, on behalf of Phelps Dodge Company, July 6, 2006.

[123] Ibid.

no plans to reopen the mine at this time.[124] Thus, no immediate threat to PDC operations are apparent at this site. However, should PDC seek to secure water for future mining efforts at this mine in the future, spikedace and loach minnow considerations could delay or hinder those efforts.

United Verde Mine

154. The United Verde mine is located near the Verde River in Complex 1. The mine closed in 1953 and is currently in a long-term "care and maintenance" phase. PDC does not have reserve estimates for the mine, but it states that 25 million short tons of geologic material containing six percent zinc 0.9% copper, some silver, and some gold may be present at the mine. According to PDC, restrictions on water withdrawals because of critical habitat designation could result in reductions in PDC revenues if the company were to resume mining operations at this site.[125]

155. PDC also owns property in the Verde Valley that it leases to farmers and ranchers who irrigate the leased lands. PDC is concerned that, if the proposed CHD delays or prevents maintenance or repair for water-diversion structures, lessees could adversely affect the lessees, and potentially reduce the value of the leases to PDC. PDC is similarly concerned that the value of these "non-mineralized" properties, which are becoming valuable assets in the Verde Valley, could be affected by restrictions on use imposed by spikedace and loach minnow conservation efforts.[126] Potential impacts of CHD on land values associated with reduced water use is further discussed in Section 3 of this report.

5.5.2 POTENTIAL IMPACTS TO ASARCO, INC.

156. ASARCO, Inc. is a subsidiary of Grupo Mexico, S.A. de C.V. and the third largest producer of copper in the world.[127] AZDWR data indicate that seven industrial wells that supply the Ray Complex fall within proposed CHD. The Ray Complex is composed of the Ray Mine, located roughly four to five miles north of the Gila River in Complex 3, and Hayden Operations, located adjacent to the Gila River. These well fields provide the water used in the mining, leaching, milling, and smelting processes at both Hayden and Ray, as well as water for the town of Hayden and the employees of the Ray and Hayden operations. With the exception of a limited amount of water drawn from the Robinson Ranch, these wells are the only source of water for the Ray Complex. If CHD affects

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[124] Fennemore Craig, P.C., Public Comment on Draft EA for Southwestern Willow Flycatcher, submitted on behalf of the Phelps Dodge Corporation, July 18, 2005.

[125] NERA Economic Consulting, Comments on 'Economic Analysis of Critical Habitat Designation for the Spikedace and Loach Minnow,' prepared by Industrial Economics, Inc. (IEC), July 6, 2006 submitted with public comments by Norman James, Fennemore Craig, on behalf of Phelps Dodge Company, July 6, 2006.

[126] Ibid.

[127] On August 10, 2005, ASARCO LLC filed for Chapter 11 bankruptcy protection in U.S. Bankruptcy Court in Corpus Christi, Texas.

ASARCO's ability to draw on these wells, mining operations at the Ray Complex could be severely impacted.[128]

157. Some activities at the Hayden Operations are located within proposed CHD. These activities include: the AB-BC tailing ponds, the Last Chance tailings runoff/collection ponds, portions of the 24-inch Hayden-Ray water pipe line, portions of the 14-inch PZ Ranch to Hayden water line, a public river crossing, and portions of the leased cotton fields at the PZ and possibly the Crescent Ranches. ASARCO is particularly concerned that the designation of critical habitat could possibly delay maintenance and repair of the operations and facilities located within CHD if Section 7 consultation is required. Such delay could cause ASARCO to fall out of compliance with its stormwater and other permit requirements.[129]

158. The Ray Complex as a whole produces approximately 350 million tons of copper annually. It employs approximately 1,400 people and has a current annual payroll of $50 million.[130]

5.6 SUMMARY OF IMPACTS

159. Exhibit 5-2 presents available data for mines for which water concerns have been raised related to spikedace and loach minnow proposed CHD. The active mining operations that are known to utilize water within proposed CHD areas are the Morenci, Tyrone, and Ray mines.

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[128] Arizona Department of Water Resources, Wells 55 Database CD, 2002. This database is a record of all wells registered with the state of Arizona since reporting began in 1980 (though many wells were reported to the state retroactively). The positional accuracy of the data is somewhat limited because the well locations are reported to ADWR by township, range, section and section subdivision down to the nearest ten acres (quarter-quarter-quarter section). Thus, center points of ten-acre cells are used to represent the approximate locations of the wells. In addition, 0.05 percent of the wells in the database have no locational information. Thus, in some cases, wells may have been identified as falling within critical habitat when they do not, and vice versa. Personal communication with Krishna Parameswaran and Jack Garrity, ASARCO LLP, Feb. 22, 2006.

[129] P.C., ASARCO LLC, submitted on Feb. 21, 2006; personal communication with Krishna Parameswaran and Jack Garrity, ASARCO LLP, Feb. 22, 2006; data on mine locations from the U. S. Geological Survey's Mineral Resources Data System accessible at http://tin.er.usgs.gov/mrds/.

[130] Personal communication with Krishna Parameswaran and Jack Garrity, ASARCO LLP, Feb. 22, 2006.

EXHIBIT 5-2. MINE OPERATIONS FOR WHICH WATER CONCERNS HAVE BEEN RAISED RELATED TO SPIKEDACE AND LOACH MINNOW PROPOSED CHD

OWNER	MINE	STATE	SITE IN CHD?	MINE IS OPERATIONAL?	HYDROLOGIC CONNECTION TO PROPOSED CHD	DEPENDENCE ON PROPOSED CHD STREAM REACH	CURRENT OR POTENTIAL SOURCE OF WATER FOR MINING ACTIVITIES	QUANTITY AND VALUE OF PRODUCTION (WHERE MINE IS OPERATIONAL)
Phelps Dodge	Tyrone Mine	NM	No. Site is 17 miles southeast of Upper Gila River in **Complex 5**.	Yes.	Water diversion from proposed CHD	Surface water provides partial supply to mining operations.	Mine diverts water from Gila River to stores in Bill Evans Lake for operations.	In 2004, 1.1 billion pounds of recoverable copper (net of copper extracted). 43,100 short tons of copper produced generating $28.7 million in net operating income in 2004.
Phelps Dodge	Morenci Mine	AZ	No. Site is 6 miles east of Eagle Creek and 2-3 miles west of the San Francisco River in **Complex 4**.	Yes	Water diversion from proposed CHD.	Water supply to the mine is diverted through proposed CHD. Land/water leased to farmers and ranchers.	Mine uses water from a variety of sources including surface water rights in the San Francisco River, Chase Creek, and Eagle Creek as well as groundwater from the Upper Eagle Creek wellfield and CAP water from the San Carlos Apache	420,300 tons of copper produced in 2004. 234,491,000 tons of copper mined in 2004. Using the ten-year average price of copper of $1.05 per lb., the 420,300 tons produced in 2004 has an approximate value of $882.6 million.
Asarco Inc.	Ray Complex	AZ	No. Ray Mine is 4 to 5 miles north of Gila River in **Complex 3** Some of Hayden Operations are located within proposed CHD	Yes.	Pumps groundwater from wells located within proposed CHD	Groundwater from wells located within proposed CHD is the primary source of water for the complex	Ray Complex pumps groundwater to feed its operations: mining, leaching, milling, and smelting.	In 2001 the Ray Complex extracted 249,600,000 lbs. of copper in concentrate, 684,374 oz. of silver in concentrate, and 102,959,000 lbs. of copper in cathodes. Using the ten-year average price of copper of $1.05 per pound, the total copper produced has an approximate value of $160.2 million.

OWNER	MINE	STATE	SITE IN CHD?	MINE IS OPERATIONAL?	HYDROLOGIC CONNECTION TO PROPOSED CHD	DEPENDENCE ON PROPOSED CHD STREAM REACH	CURRENT OR POTENTIAL SOURCE OF WATER FOR MINING ACTIVITIES	QUANTITY AND VALUE OF PRODUCTION (WHERE MINE IS OPERATIONAL)
Phelps Dodge	Christmas Mine District	AZ	No. Located 1.5 miles north of the San Pedro and Gila confluence in **Complex 3**.	No. Production ceased in 1983, and now is in a care and maintenance phase.	Water diversion to support re-opening could come from proposed CHD area.	None.	None. Access to surface and/or groundwater would be required to re-open Christmas Mine. At present no water drawn from Gila River; but mine holds Gila River water rights.	PDC estimates the mine contains 1.8 billion pounds of recoverable copper.
Phelps Dodge	United Verde Mine	AZ	No. Located near Verde River in **Complex 1.**	No. Production ceased in 1953 and now is in a care and maintenance phase.	Water diversion to support re-opening could come from proposed CHD area. Land/water leased to farmers and ranchers.	Land/water leased to farmers and ranchers.	Access to surface and/or groundwater would be required to re-open United Verde Mine.	25 million short tons of geologic material containing 6 percent zinc, 0.9 percent copper, some silver and gold possibly present.

CHAPTER 6 | POTENTIAL COSTS OF SPECIES MANAGEMENT ACTIONS, INCLUDING ECONOMIC IMPACTS TO RECREATION

160. This section describes the past and expected future costs of species management actions, including impacts of those efforts on recreation in areas proposed as critical habitat for the spikedace and loach minnow. Specifically, this analysis discusses economic impacts resulting from recovery actions to mitigate the threat of non-native species to spikedace and loach minnow. The analysis also estimates direct and indirect economic impacts on recreational activities such as fishing and OHV use due to spikedace and loach minnow conservation activities. This section is divided into two parts: (1) an overview of fish management activities, recreational angling, and OHV use that take place within proposed CHD; and (2) a discussion of the types of past and potential economic impacts of spikedace and loach minnow conservation, including a presentation of impacts by river reach.

6.1 SUMMARY OF COSTS OF SPECIES MANAGEMENT ACTIONS

6.1.1 PAST COSTS

161. Past impacts of species management actions for spikedace and loach minnow in proposed CHD areas include costs resulting from a 2001 USBR consultation on the CAP, the cessation of rainbow trout stocking in Eagle Creek and the Blue River, and several road closures in Prescott National Forest. The most significant of these costs are associated with the USBR consultation, amounting to approximately $6.9 million (see Exhibit 6-1). These costs include: a $500,000 annual payment from USBR to the Service to control non-native species and to recover native species, $3 million to install fish barriers on Aravaipa Creek, and the costs of annual monitoring on the Gila River and Aravaipa Creek. It should be noted that conservation activities undertaken using these funds are likely to benefit multiple threatened and endangered species. In addition, some funds may have been distributed outside of proposed CHD areas. For these reasons, estimated expenditures for this consultation related to conservation efforts for the spikedace and loach minnow within proposed CHD areas may overstate actual expenditures. Other costs identified by the New Mexico Department of Game and Fish (NMDGF) include: $30,000 annually to monitor eight sites located within the Gila-San Francisco drainage, $5,000 annually to provide data and expertise, and a one-time cost of $15,000 to compile, synthesize, and analyze data collected at monitoring sites for spikedace and loach minnow.

162. The AZGFD ceased stocking of sportfish in Eagle Creek and the Blue River in Apache-Sitgreaves National Forest due to native fish considerations in the late 1990s and began stocking endangered Gila trout in these reaches instead. Spikedace and loach minnow were among numerous species considered when these stocking cessations were put in place. Although several citizens at a public hearing held in Thatcher, AZ in 1999 voiced disappointment that the sites are no longer stocked, these changes in stocking have not affected the overall number of fish stocked in Arizona.[131] However, there may have been consumer surplus losses associated with these closures because anglers may now take trips to less preferred sites. Past impacts on OHV use due to these species have not been documented.

6.1.2 FUTURE COSTS

163. Future costs associated with spikedace and loach minnow conservation activities are forecast to be between $8.4 million and $17.2 million over 20 years, assuming a discount rate of seven percent (see Exhibit 6-2). These costs include species management costs ($8.4 to $8.5 million) as well as potential costs associated with lost recreational fishing activity on two stream segments where non-native fish stocking currently occurs ($0 to $8.6 million), assuming a discount rate of seven percent. It should be noted that one of these reaches (the Verde River) is also designated as critical habitat for the razorback sucker. Thus, species management actions undertaken on this reach will benefit both spikedace and razorback sucker.

164. Future species management costs derive primarily from the implementation of the 2001 USBR consultation. Under this consultation, two new fish barriers, at a cost of $1.5 million each, will be installed on the Blue River and the Verde River by 2015. These barriers will carry an additional annual cost of $2,000 for monitoring (undiscounted dollars). Future costs also include the annual fund transfer from the USBR to the Service as well as the continuing annual costs of monitoring the Gila River and the existing barrier on Aravaipa Creek. Other potential species management costs include the costs of NMDGF conservation activities: $30,000 annually to continue monitoring eight sites in the Gila-San Francisco drainage, $5,000 annually for the provision of data and expertise by NMDGF, $30,000 per year for four years for the mechanical removal of nonnatives in East, West, and Middle Forks of the Gila, $20,000 per year for three years for systematic inventory of species in these reaches, and a proposed barrier on Little Creek costing $500,000 to $750,000 (undiscounted dollars). Both the NMDGF and USBR expenditures described here are intended to benefit multiple threatened and endangered species.

165. Areas currently stocked with non-native rainbow trout include the Lower Verde (Camp Verde area) of the Verde River in Complex 1 and East Fork Gila River in Complex 5.[132] The future impact of proposed CHD on the stocking regimes in these reaches is unknown,

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[131] State fish managers must identify alternate sites for fishing when areas are closed to stocking. Personal communication with Bill Wall, Feb. 17, 2006.

[132] Most of the proposed Verde River segment is not managed for sportfish. The Lower Verde Area, which includes the town of Camp Verde, is stocked with trout. The Upper Verde supports only 191 annual angler days of non-trout fishing. Public comments of Bob Broscheid, Habitat Branch Chief, Arizona Game and Fish Department, July 6, 2006.

as is the reduction in fishing activity that would occur if stocking is curtailed. Further, it is unknown whether non-native trout may be replaced with stocked native fish (e.g. Apache trout). Thus, this analysis estimates the value of angler days at risk if sportfish stocking were discontinued on these reaches as part of the high end estimates. Angling trips are valued at approximately $8.6 million over 20 years, assuming a discount rate of seven percent. It should be noted that because State fish managers typically identify alternative sites for stocked fish when areas are closed to stocking, these angler days are likely to be redistributed to other areas rather than lost altogether. Thus, the high-end estimate does not consider the possibility, that rather than not fishing at all in response to reduced stocking, recreators will visit alternative, albeit less desirable fishing sites. Existing models of angler behavior in response to changes in stocking regimes in these areas were not available to refine this estimate.

166. The proposed CHD areas where OHV use is most prevalent are within Apache-Sitgreaves National Forest, which contains several reaches in proposed CHD in Complex 2 and 4.[133] Representatives of two OHV groups have expressed concern that OHV use could be curtailed as a result of proposed CHD for the spikedace and loach minnow. However, no past closures have been documented associated with past CHDs for spikedace and loach minnow. Thus, this analysis does not attempt to quantify future impacts of spikedace and loach minnow conservation on OHV use.

[133] Proposed CHD reaches that cross Apache-Sitgreaves include: Blue River, Boneyard Creek, Campbell Blue Creek, East Fork Black River, Eagle Creek, Little Blue Creek, North East Fork Black River, and the San Francisco River.

EXHIBIT 6-1. PAST COSTS ASSOCIATED WITH SPECIES MANAGEMENT AND RECREATION, (1986-2005)

RIVER SEGMENT	RECURRING SPECIES MANAGEMENT COSTS (20 YEARS, UNDISCOUNTED)	ONE-TIME COSTS (UNDISCOUNTED)	TOTAL COSTS (UNDISCOUNTED)	PRESENT VALUE, DISCOUNTED AT 7 PERCENT ($2005)
Aravaipa Creek	$635,000[1]	$3,000,000[2]	$3,635,000	$4,663,000
Blue River	$625,000[1]	$0	$625,000	$719,000; replacement of rainbow trout stocking with Gila trout
Verde River	$625,000[1]	$0	$625,000	$719,000; 5-10 road closures
Gila River	$675,000[1]	$0	$675,000	$776,000
San Francisco River	$57,000[3]	$2,000[4]	$59,000	$90,000
Whitewater Creek	$57,000[3]	$2,000[4]	$59,000	$90,000
Negrito Creek	$57,000[3]	$2,000[4]	$59,000	$90,000
Tularosa River	$57,000[3]	$2,000[4]	$59,000	$90,000
Upper Gila	$57,000[3]	$2,000[4]	$59,000	$90,000
West Fork Gila	$57,000[3]	$2,000[4]	$59,000	$90,000
East Fork GIla	$57,000[3]	$2,000[4]	$59,000	$90,000
Middle Fork Gila	$57,000[3]	$2,000[4]	$59,000	$90,000
Eagle Creek	$0	$0	$0	Replacement of rainbow trout stocking with Gila trout
Total				**$7,597,000**

Sources: Personal communication with Rob Clarkson, Bureau of Reclamation, Feb. 14, 2006; personal communication with Kirk Young, Arizona Game and Fish, Feb. 13, 2006; written communication with David Propst, New Mexico Department of Game and Fish, Feb. 20, 2006.

Notes: Totals may not sum due to rounding. Past costs result from a consultation with USBR on non-native species reintroduction regarding nine species: Gila topminnow, razorback sucker, desert pupfish, Colorado squawfish, spikedace, loach minnow, bald eagle, Gila trout, and Apache trout.

[1] Annual costs of implementing this opinion include an annual $500,000 fund transfer from USBR to the Service. For the purposes of this analysis, the $500,000 fund transfer is distributed across the stream reaches where USBR conservation activities occur within proposed CHD. However, conservation activities undertaken using this money are likely to benefit other species. In addition, some funds may have been distributed outside of proposed CHD areas. For these reasons, costs related to conservation efforts for the spikedace and loach minnow in proposed CHD areas may overstate actual costs. Other annual costs resulting from this consultation include $2,000 annually to monitor the fish barrier on Aravaipa Creek and $10,000 annually to monitor for non-native presence on the Gila River.

[2] Other costs include $3 million to install a pair of fish barriers on Aravaipa Creek.

[3] Annual costs include $30,000 per year to monitor eight sites located within the Gila-San Francisco drainage and $5,000 per year for NMDGF to provide data and expertise. These costs have been divided across the eight reaches in the Gila-San Francisco drainage beginning in 1998 when monitoring started. Costs for a particular reach may be overstated.

[4] Other costs are $15,000 to compile, synthesize, and analyze data collected at monitoring sites for spikedace and loach minnow. This cost has been divided across the eight reaches in the Gila-San Francisco drainage. Costs for a particular reach may be overstated.

EXHIBIT 6-2. FUTURE COSTS ASSOCIATED WITH SPECIES MANAGEMENT AND RECREATION, 2006-2025

RIVER SEGMENT	RECREATION-RELATED COSTS (20 YEARS, UNDISCOUNTED)	RECURRING SPECIES MANAGEMENT COSTS (20 YEARS, UNDISCOUNTED)	ONE-TIME COSTS (UNDISCOUNTED)	TOTAL COSTS (UNDISCOUNTED)	PRESENT VALUE, DISCOUNTED AT 7 PERCENT ($2005)[8]
Aravaipa Creek	$0	$2,540,000[1]	$0	$2,540,000	$1,345,000
Blue River	$0	$2,540,000[1]	$1,500,000[2]	$4,040,000	$2,399,000
Verde River	$0-$16,003,000[3]	$2,540,000[1]	$1,500,000[2]	$4,040,000-$20,043,000	$2,399,000-$10,876,000
Gila River	$0	$2,700,000[1]	$0	$2,700,000	$1,430,000
San Francisco River	$0	$88,000[4]	$0	$88,000	$46,000
Whitewater Creek	$0	$88,000[4]	$0	$88,000	$46,000
Negrito Creek	$0	$88,000[4]	$0	$88,000	$46,000
Tularosa River	$0	$88,000[4]	$0	$88,000	$46,000
Upper Gila	$0	$88,000[4]	$0	$88,000	$46,000
West Fork Gila	$0	$148,000[5]	$500,000-$750,000[7]	$648,000-$898,000	$364,000-$523,000
East Fork Gila	$0-$320,000[6]	$148,000[5]	$0	$148,000-$320,000	$98,000-$267,000
Middle Fork Gila	$0	$148,000[5]	$0	$148,000	$98,000
				Total	**$8,365,000-$17,170,000**

Source: Personal communication with Rob Clarkson, Bureau of Reclamation, Feb. 14, 2006.

Notes: Totals may not sum due to rounding. Costs result from a consultation with USBR on non-native species reintroduction regarding nine species: Gila topminnow, razorback sucker, desert pupfish, Colorado squawfish, spikedace, loach minnow, bald eagle, Gila trout, and Apache trout.

[1] Annual costs of implementing this opinion include an annual $500,000 fund transfer from USBR to the Service. For the purposes of this analysis, the $500,000 fund transfer is distributed across the four stream reaches where USBR conservation activities occur within proposed CHD: Aravaipa Creek, the Verde River, the Blue River, and the Gila River. However, conservation activities undertaken using this money are likely to benefit other species. In addition, some funds may be distributed outside of proposed CHD areas. For these reasons, costs related to conservation efforts for the spikedace and loach minnow in proposed CHD areas may overstate actual costs. Other annual costs resulting from this consultation include $10,000 annually to monitor for non-native presence on the Gila River and $2,000 annually to monitor the fish barriers on Aravaipa Creek, Blue River, and Verde River.

[2] Other costs include the installation of fish barriers on Blue River and Verde River, costing $1,500,000 each. These barriers are to be completed by 2015 at the latest.

[3] Costs for the Verde River also include the potential loss of 13,000 annual angler use days (high end estimate) for the Lower Verde (Camp Verde area). At $61.55 per day, this effort is valued at approximately $800,150 (undiscounted) annually. Most of the proposed Verde River segment is not managed for sportfish. The Upper Verde supports only 191 annual angler days of non-trout fishing. Public comments of Bob Broschied, Habitat Branch Chief, Arizona Game and Fish Department, July 6, 2006.

[4] Annual costs include $30,000 per year to monitor eight sites located within the Gila-San Francisco drainage and $5,000 per year for NMDGF to provide data and expertise. These costs have been divided across the eight reaches in the Gila-San Francisco drainage. Costs for a particular reach may be overstated.

[5] Annual costs the costs mentioned in note [4] above as well as well as $30,000 per year for four years for mechanical removal of nonnative fish and $20,000 per year for three years for systematic inventory. These costs have been divided equally across the three reaches: East, West, and Middle Forks Gila River.

[6] Costs for the East Fork Gila River also include the potential loss of 260 annual angler use days (high end estimate). At $61.55 per day, this is approximately $16,003 (undiscounted) annually.

[7] Cost of the proposed barrier on Little Creek, a tributary of the West Fork Gila.

[8] Non-quantified impacts may include reductions in lands available for OHV use in Apache-Sitgreaves National Forest. Proposed CHD reaches located within the forest include: Blue River, Boneyard Creek, Campbell Blue Creek, East Fork Black River, Eagle Creek, Little Blue Creek, North Fork East Fork Black River, and the San Francisco River.

6.2 OVERVIEW OF FISH MANAGEMENT ACTIONS IN CRITICAL HABITAT AREAS

167. The Desert Fishes Team in Arizona found in 2003 that "…the control and removal of nonnative fish and certain other aquatic flora and fauna is the most urgent and overriding need in preventing the continued decline and ultimate extinction of the native fish assemblage of the Basin."[134] Non-native fish introductions are identified as a threat on 19 out of the 25 proposed CHD reaches. This analysis will address direct costs associated with treatment efforts for non-native fish removal in proposed CHD areas.

168. Non-native fish species have been and are currently introduced deliberately by state and Federal agencies in order to provide game fish for recreational anglers. Other non-native species, including algae, parasites and plants, have been introduced from other sources such as boats and bait fish. Many of these species live in waters where spikedace and loach minnow are found. As detailed in section 6.4 and Exhibits 6-8 through 6-12, stocking of non-native fish currently occurs in two proposed CHD stream reaches.

6.3 OVERVIEW OF RECREATION ACTIVITIES IN CRITICAL HABITAT AREAS

6.3.1 FISHING

169. Recreators spent more than $415 million on fishing in 2001 in Arizona, of which an estimated 19.7 percent was spent within counties containing proposed CHD for the spikedace and loach minnow. Exhibit 6-3 presents the total expenditures of recreators participating in fishing recreation within proposed CHD in 2001.

170. The Arizona State University West School of Management's Dr. Silberman published two reports on the importance of recreation to Arizona's economy. In "The Economic Importance of Fishing and Hunting," he estimates that roughly 5.3 million days are spent on fishing trips in Arizona annually. Roughly 23 percent of the total fishing days in the state are spent within Arizona counties containing proposed CHD for the spikedace and loach minnow (see Exhibit 6-4). Of the $415 million spent on fishing trips in Arizona, 20 percent of those expenditures occurred in counties containing proposed CHD. Fishing recreation in New Mexico generated fewer expenditures overall, only $178 million in 2001. Exhibit 6-5 presents some data on the number of anglers, days of fishing, and trip-related expenditures for New Mexico. Specific information related to fishing efforts on stream segments located within proposed CHD is presented in Exhibits 6-8 through 6-12. This data indicates that, while several reservoirs upstream of proposed CHD are heavily used by recreational angers, CHD stream reaches are generally not heavily used by recreational anglers, with the exception of the Verde River segment.

[134] Status of Federal and State Listed Warm Water Fishes of the Gila River Basin, with Recommendations for Management. Desert Fishes Team, Report Number 1, October 15, 2003.

EXHIBIT 6-3. TRIP RELATED EXPENDITURES ON FISHING BY COUNTIES IN ARIZONA WITH SPIKEDACE AND LOACH MINNOW PROPOSED CHD (2001)

	TRIP EXPENDITURES	*% OF STATE*
Arizona	**$415,981,000**	**100.0%**
Apache	$36,965,000	8.9%
Graham	$2,508,000	0.6%
Greenlee	$440,000	0.1%
Navajo	$15,491,000	3.7%
Pinal	$6,870,000	1.7%
Yavapai	$19,875,000	4.8%
Total CHD counties	**$82,147,000**	**19.7%**

Source: Silberman, Jonathan. The Economic Importance of Fishing and Hunting. Arizona State University, School of Management.

EXHIBIT 6-4. NUMBER OF FISHING DAYS BY COUNTIES IN ARIZONA THAT CONTAIN SPIKEDACE AND LOACH MINNOW PROPOSED CHD (2002)

	ANGLER DAYS COUNTY	ANGLER DAYS TRAVELING	ANGLER DAYS NON-RESIDENT	TOTAL ANGLER DAYS	PERCENT OF STATE
Arizona	**2,263,000**	**2,702,000**	**338,000**	**5,303,000**	**100%**
Apache	39,000	580,000	29,000	648,000	12.22%
Graham	7,000	29,000	2,000	38,000	0.71%
Greenlee	324	245	910	1,000	0.03%
Navajo	82,000	141,000	849	224,000	4.22%
Pinal	2,000	23,000	279	25,000	0.47%
Yavapai	81,000	192,000	3,000	276,000	5.21%
Total CHD counties	**211,000**	**964,000**	**37,000**	**1,212,000**	**22.86%**

Source: Silberman, Jonathan. The Economic Importance of Fishing and Hunting. Arizona State University, School of Management.

Notes:

"Residents" are defined as local residents within their own county. "Traveling" is defined as residents traveling within the state. "Non-resident" is defined as individuals who do not live in Arizona.

Information related to fishing on stream segments located within proposed CHD is presented in Exhibits 6-8 through 6-12.

EXHIBIT 6-5. EXPENDITURES ON FISHING IN NEW MEXICO (2001)

	ANGLERS	DAYS OF FISHING	AVERAGE DAYS PER ANGLER	TRIP-RELATED EXPENDITURES
New Mexico Residents	215,000	2,407,000	11	$88,077,000
Non-residents	314,000	2,485,000	8	$90,653,000
Total	**529,000**	**4,892,000**		**$178,730,000**

Source: U.S. Department of the Interior. 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation: New Mexico. 2002.

6.3.2 OFF-HIGHWAY VEHICLE USE

171. In addition to his overview of the economic impact of fishing, Dr. Silberman published a similar report on the OHV market in Arizona. In "The Economic Importance of Off-Highway Vehicle Recreation," which includes economic data on off-highway vehicle recreation for the State of Arizona by county, he estimates that OHV drivers in Arizona spend about $842.3 million on off-highway recreation annually. An estimated 27 percent of these OHV-related expenditures are made within counties containing proposed CHD for the spikedace and loach minnow. Exhibit 6-6 presents the number of days spent participating in and expenditures on OHV recreation within counties containing proposed CHD in 2002. Specific information related to OHV use on stream segments located within proposed CHD is presented in Exhibits 6-8 through 6-12. These data indicate that the Apache-Sitgreaves river segments are most heavily used by OHV users.[135]

[135] Proposed CHD reaches that cross Apache-Sitgreaves include: Blue River, Boneyard Creek, Campbell Blue Creek, East Fork Black River, Eagle Creek, Little Blue Creek, North East Fork Black River, San Francisco River.

EXHIBIT 6-6. EXPENDITURES ON OFF HIGHWAY RECREATION IN ARIZONA (2002)

	TOTAL DAYS	ACTIVITY DAYS RESIDENTS	ACTIVITY DAYS TRAVELING	TRIP EXPENDITURES	PERCENT OF STATE EXPENDITURES
Arizona	**12,225,000**	**5,500,000**	**6,725,000**	**$842,316,000**	**100%**
Apache	896,000	153,000	743,000	$47,569,000	5.6%
Graham	210,000	66,000	144,000	$12,433,000	1.5%
Greenlee	89,000	33,000	57,000	$5,329,000	0.6%
Navajo	75,000	439,000	306,000	$48,743,000	5.8%
Pinal	600,000	198,000	402,000	$40,184,000	4.8%
Yavapai	1,196,000	417,000	779,000	$70,556,000	8.4%
Total CHD counties	**3,736,000**	**1,305,505**	**2,430,004**	**$224,814,000**	**26.7%**

Source: Silberman, Jonathan. The Economic Importance of Off-Highway Vehicle Recreation. Arizona State University, School of Management.
Notes:
"Residents" are defined as local residents within their own county. "Traveling" is defined as residents traveling within the state in pursuit of OHV recreation.

6.4 COSTS OF FISH MANAGEMENT AND ECONOMIC IMPACTS ON RECREATION ACTIVITIES

172. Fish management actions can result in direct costs to State and Federal agencies. In addition, fish management can indirectly affect recreational activities if those activities are not allowed or become impractical due to fish management actions. Categories of economic impacts of fish management include:

- **Administrative costs:** Costs resulting from the need for affected Federal agencies to consult on recreational activities. Past administrative costs associated with species management, recreation, and fish recovery efforts are estimated at $256,000 to $640,000 ($2005). Future administrative costs are estimated at $256,000 to $640,000 over 20 years (undiscounted $2005) (see Appendix A.)
- **Recovery actions:** Costs resulting from efforts made to preserve and recover spikedace and loach minnow habitat, especially to protect these species against the threat of non-native species. The recovery plans for spikedace and loach minnow indicate that the introduction of non-native species, whether for sport, forage, bait or by accident, has contributed to the decline of spikedace and loach minnow population. Non-native fish species that could potentially impact spikedace and loach minnow include catfish, largemouth bass, smallmouth bass, green sunfish, brown trout, rainbow trout, and red shiner. Possible recovery actions include the installation of fish barriers, increased monitoring, and non-native fish removal.
- **Limits on recreation:** Costs resulting from cessation of stocking of game fish in CHD areas, closing roads to OHV use, or limiting OHV use to already constructed crossings.

173. Past and potential future economic impacts on recreation were determined by reviewing the consultation history for the spikedace and loach minnow as well as through discussions with officials at various agencies including AZGFD, NMDGF, USBR as well as Prescott, Apache-Sitgreaves, and Gila National Forests.

6.4.1 COST OF FISH MANAGEMENT ACTIONS

174. Since the listing of the species, the Service has conducted nine consultations that involved non-native species. The most significant of these, with the most associated costs, was a consultation with USBR for which a final biological opinion was issued in 2001. As discussed above, this consultation considers potential non-native species introductions that could occur as part of interbasin water transfer through the CAP. Its action area is the entire Gila River basin, other than the Santa Cruz subbasin. It resulted in a number of project modifications that were implemented by USBR, including an agreement to install non-native fish barriers, to monitor fish populations, and to transfer $500,000 annually from USBR to the Service for the control of non-natives species and to recover native species for 30 years. Past costs associated with this consultation include the installation of a pair of fish barriers on Aravaipa Creek for $3 million total, $2,000 annually for monitoring this barrier, $10,000 annually for monitoring the Gila River, and the $500,000 annual transfer of funds. Future costs are anticipated to include the installation of fish barriers on the Blue River and the Verde River for $1.5 million each, monitoring of these barriers costing $2,000 annually per barrier, and the continuation of the other annual costs, including the $500,000 fund transfer.[136] These annual costs are projected over the next 20 years to arrive at total estimated future costs (see Exhibit 6-2).

6.4.2 RECREATIONAL FISHING IMPACTS

Past Closures

175. The AZGFD ceased to stock sportfish in Eagle Creek and the Blue River in Apache-Sitgreaves National Forest due to native fish considerations in the late 1990s. Spikedace and loach minnow were among numerous species considered when these stocking cessations were put in place. These reaches are currently stocked as part of a recovery effort for the Gila trout, an endangered native fish. In May 2005, the Service proposed to reclassify the Gila trout as threatened with a special rule allowing recreational fishing of the species.[137] The opportunity to catch Gila trout, which are only found in Arizona and New Mexico, may attract anglers to these areas in the future.[138]

176. Under AZGFD fish commission requirements, AZGFD must identify alternate stocking sites when stocking is discontinued at a particular location. As a result, AZGFD estimates that changes in stocking on Eagle Creek and the Blue River have not affected

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[136] Personal communication with Rob Clarkson, U.S. Bureau of Reclamation, Feb. 14, 2006.

[137] 50 CFR 17.

[138] Craig Springer, "Native Trout Conservation Pays Dividends," ESPN.com. Accessed at http://www.sports.espn.com/outdoors/conservation/columns/story?columnist=springer_craig&page=c_col_Springer_gila_economy on Mar. 14, 2006.

the overall amount fish stocking taking place in Arizona.[139] Several citizens at a public hearing held in Thatcher, AZ in 1999 voiced disappointment that these sites are no longer stocked. One public commenter also suggests that the curtailment of stocking in these reaches has caused economic impacts on local businesses. [140] Data on angler use is not available at the creek level. However, alternate angling sites for fishing Arctic grayling, rainbow trout, German brown trout, Apache trout, and cutthroat trout exist within Apache-Sitgreaves National Forest.[141] Given the existence of these alternate sites, this analysis assumes that past closures did not result in impacts to overall angler use. However, there may have been some consumer surplus losses associated with these closures because anglers may now fish at less preferred sites.

Potential Future Impacts

177. It is currently unknown whether and the extent to which non-native stocking regimes will be affected by the designation of critical habitat. For the purposes of this analysis, it is assumed that stocking outside of critical habitat itself (i.e., upstream stocking) will not be affected by proposed CHD. It is also assumed that Apache trout stocking programs will be unaffected by proposed CHD. This is because Apache trout are native fish and the Service has acknowledged in previous rules that these fish are not known to conflict with spikedace and loach minnow recovery.

178. To develop the high-end estimate, this analysis makes the simplifying assumption that the two reaches stocked with native fish will no longer be stocked and all fishing trips that would normally be taken to sites in proposed CHD areas will be lost (e.g., not taken). The analysis then transfers social welfare values for similar types of fishing trips obtained from studies published in the peer-reviewed economics literature to estimate the value of the lost trips ($61.55 per angler use day), as summarized in Exhibit 6-7. To develop the low-end estimate, it is assumed that stocking will continue in these reaches with no effect on fishing trips, or, if stocking is discontinued, that trips are reallocated to alternate sites of equal value to anglers.

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[139] Personal communication with Kirk Young, Arizona Game and Fish Department, Feb. 13, 2006; personal communication with Bill Wall, Feb. 17, 2006.

[140] Public comments of D. Ely, July 6, 2006.

[141] Apache-Sitgreaves National Forest: Wildlife, accessed at http://www.fs.fed.us/r3/asnf/recreation/wildfish.shtml on Mar. 15, 2006.

EXHIBIT 6-7. SUMMARY OF FISHING WELFARE VALUES

STATE	WELFARE VALUES (2005$)
Arizona	$53.34
New Mexico	$69.75
Average	**$61.55**

Notes: Welfare Values are adjusted to current dollars using the GDP Deflator, Budget of the United States Government, Fiscal Year 2005, Historical Tables.
Source: U.S. Fish and Wildlife Service. Net Economic Values for Wildlife-Related Recreation in 2001: Addendum to the 2001 National Survey of Fishing, Hunting and Wildlife-Associated Recreation. 2003.

179. The following text notes places where proposed CHD and current sportfish stocking regimes overlap. Three reaches located in proposed CHD currently have ongoing stocking, two of which are stocked with non-native sportfish:

- **Verde River:** Most of the proposed Verde River segment is not managed for sportfish. The Lower Verde Area, which includes the town of Camp Verde, is stocked with trout. Stocked trout generates 13,000 angler days annually for the entire Cottonwood (Lower Verde) area.[142] At $61.55 per angler day, the value of these angler days is estimated to be $800,150 annually. The Upper Verde supports only 191 annual angler days of non-trout fishing. [143]
- **East Fork Black River:** The reach is stocked with approximately 28,000 catchable Apache trout and supports approximately 38,687 angler-use days annually. Apache trout is a native fish. According to a public comment from AZGFD as well as the Service's 2000 Final Rule designating critical habitat, Apache trout are "not known to conflict with the recovery of either spikedace or loach minnow."[144] Therefore, this analysis assumes that stocking in East Fork Black River will not be affected by spikedace and loach minnow proposed CHD, and that no loss of angler days will occur.[145]
- **East Fork Gila River:** The reach is currently stocked with approximately 5,000 rainbow trout annually. There is low angler use on this reach of less than five days

[142] Personal communication with Kirk Young, Arizona Game and Fish Department, Feb. 13, 2006; Pringle, Todd. Statewide Survey of 2001 Arizona Anglers. Statewide Fisheries Investigations, Federal Aid Project F-7-M-46, 2004.

[143] Public comments of Bob Broschied, Habitat Branch Chief, Arizona Game and Fish Department, July 6, 2006. The Verde River is also designated as critical habitat for the razorback sucker.; therefore, species management actions undertaken on this reach may benefit both species.

[144] Public comment from the Arizona Game and Fish Department, dated Feb. 21, 2006.

[145] AZGFD notes that AZGFD notes that if Apache trout stocking were affected by proposed CHD, significant economic impacts could occur. Public comment from the Arizona Game and Fish Department, dated Feb. 21, 2006.

a week.[146] At $61.55 per angler day, the value of these angler days is estimated to be $16,003 annually.

180. Non-native fish are stocked in lakes upstream of several proposed CHD reaches. AZGFD believes that such stocking does not negatively affect critical habitat and should have no adverse effect on the species. This analysis assumes that upstream stocking regimes will not be affected by proposed CHD. AZGFD notes that if upstream stocking were affected by proposed CHD, significant economic impacts could occur.[147]

- **East Fork Black River, North Fork East Fork Black River, Boneyard Creek:** Big Lake and Crescent Lake are located upstream of all segments in Complex 2. According to AZGFD, "Big Lake is likely the most popular angling/camping destination in the White Mountains, generating 168,990 angler days a year." It is stocked with rainbow trout, brook trout, cutthroat trout, and occasionally Apache trout. Crescent Lake is stocked with rainbow trout and brook trout. It supports 25,769 angler-use days annually. AZGFD notes that both of these lakes "rarely spill," meaning nonnative trout rarely escape downstream to critical habitat areas.
- **San Francisco River:** Luna Lake in the San Francisco headwaters is stocked. It supports 24,600 angler-use days a year.[148]
- **Whitewater Creek:** Glenwood Pond (adjacent to the creek) is stocked with approximately 5,500 rainbow trout per year.[149]
- **Negrito Creek:** Negrito Creek is stocked upstream of critical habitat with 1,500 10" rainbow trout annually.[150]

6.4.3 OHV USE

181. The proposed CHD areas where OHV use is most prevalent are within Apache-Sitgreaves National Forest, which contains several reaches in proposed CHD in Complex 2 and 4.[151] Representatives of two OHV groups have expressed concern that OHV use could be curtailed as a result of proposed CHD for the spikedace and loach minnow.[152]

182. OHV use on USFS lands in Arizona is being re-examined as part of a Draft Environmental Impact Statement (DEIS) that examines all Cross-Country travel by OHVs in Arizona National Forests. The creation of the DEIS was prompted by numerous

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[146] Written communication with David Propst, New Mexico Game and Fish Department, Feb. 20, 2006.

[147] Personal communication with Kirk Young, Arizona Game and Fish Department, Feb. 13, 2006.

[148] Pringle, Todd. Statewide Survey of 2001 Arizona Anglers. Statewide Fisheries Investigations, Federal Aid Project F-7-M-46, 2004.

[149] Written communication with David Propst, New Mexico Game and Fish Department, Feb. 20, 2006.

[150] Written communication with David Propst, New Mexico Game and Fish Department, Feb. 20, 2006.

[151] Proposed CHD reaches that cross Apache-Sitgreaves include: Blue River, Boneyard Creek, Cambell Blue Creek, East Fork Black River, Eagle Creek, Little Blue Creek, North East Fork Black River, San Francisco River.

[152] Public Hearing, Thatcher, Arizona, December 15, 1999.

factors including concerns that continuing unrestricted OHV use could increase the spread of noxious weeds, cause erosion, create user conflicts, disrupt wildlife, and damage wildlife habitat.[153] The DEIS does not change lands currently designated for intensive OHV use or lands currently closed to OHV use. However, areas currently designated as open seasonally or year-round would be restricted pending site-specific planning through which areas might be re-opened.

183. The USFS plans to implement internal direction to limit OHV use in riparian areas to benefit seven endangered species including the spikedace and loach minnow as part of the DEIS program.[154] However, any future changes to OHV use will be subject to public review and will take into consideration spikedace and loach minnow conservation along with other riparian species concerns, public concerns, and other USFS priorities.[155] Thus, future changes to OHV use will result from multiple causes, and specific future changes are not known. Potential impacts that may be caused by spikedace and loach minnow conservation activities are therefore not quantified.

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[153] Forest Service, Draft Environmental Impact Statement (DEIS) for Cross-Country Travel by OHV's, accessed at http://www.fs.fed.us/r3/ohv/deis/xcountry-deis.pdf on Feb. 15, 2006; USDA Forest Service. Biological Assessment for The Continued Implementation of the Land and Resource Management Plans for the Eleven National Forests and National Grasslands of the Southwestern Region, Appendix E: Regional Management Direction for Species and Forest Accomplishments. 2004.

[154] The USFS issued a "7 Species Direction" in 1997 that provided guidance to forest managers on appropriate management activities for seven threatened and endangered species. Working to exclude OHV use from within loach minnow and spikedace habitat as well as mitigating the impacts of recreational activities were some of the goals of the regional 7 Species Direction implemented in 1997. The 7 Species Direction was designed by the Service and the Forest Service as a means of protecting various listed species and their habitats. Species covered by the plan include the Pima pineapple cactus, the southwestern willow flycatcher, the loach minnow, and spikedace. It applies to all USFS lands in the Southwestern Region; USDA Forest Service. Biological Assessment for The Continued Implementation of the Land and Resource Management Plans for the Eleven National Forests and National Grasslands of the Southwestern Region, Appendix E: Regional Management Direction for Species and Forest Accomplishments. 2004.

[155] Personal communication with Kirk Young, Arizona Department of Game and Fish, Feb. 13, 2006; Forest Service, Draft Environmental Impact Statement (DEIS) for Cross-Country Travel by OHV's, accessed at http://www.fs.fed.us/r3/ohv/deis/xcountry-deis.pdf on Feb. 15, 2006.

EXHIBIT 6-8. SUMMARY OF RECREATIONAL IMPACTS FOR COMPLEX 1

RIVER SEGMENT	RECREATION ACTIVITIES	PAST RECREATION IMPACTS	PAST RECOVERY EFFORTS	FUTURE RECREATION IMPACTS	FUTURE RECOVERY EFFORTS
Verde River	Fishing, hiking, camping, OHV use[1]	5 to 10 road closures in Prescott National Forest due to 7 Species Direction; not anticipated to reduce visitation[1]	Species establishment in hatchery funded through $500,000 fund transfer from USBR[2]	Potential discontinuing of non-native fish stocking in the Camp Verde area. Potential loss of 13,000 annual angler use days at a total annual cost of $800,150.[3]	Potential installation of interim barriers in the next ten years[4]; USBR plans to install a fish barrier costing $1.5 million by 2015[2]; barrier will cost $2,000 annually to monitor[2]

Source:
[1] Personal communication with Albert Sillas, Prescott National Forest, Feb. 1, 2006
[2] 02-21-90-F-0119a; Personal communication with Rob Clarkson, U.S. Bureau of Reclamation, Feb. 14, 2006
[3] Most of the proposed Verde River segment is not managed for sportfish. The Lower Verde Area, which includes the town of Camp Verde, is stocked with trout. The Upper Verde supports only 191 annual angler days of non-trout fishing. Public comments of Bob Broschied, Habitat Branch Chief, Arizona Game and Fish Department, July 6, 2006.
[4] Personal communication with Kirk Young, Arizona Game and Fish, Feb. 13, 2006

EXHIBIT 6-9. SUMMARY OF RECREATIONAL IMPACTS FOR COMPLEX 2

RIVER SEGMENT	RECREATION ACTIVITIES	PAST RECREATION IMPACTS	PAST RECOVERY EFFORTS	FUTURE RECREATION IMPACTS	FUTURE RECOVERY EFFORTS
East Fork Black River	In Apache-Sitgreaves National Forest, common recreational activities include hiking, camping, fishing, and OHV use[1]	Under the Arizona OHV DEIS, Apache-Sitgreaves NF has worked to exclude OHV use from within species habitat[2]	None	Apache trout are currently stocked and generate 25,000 annual angler use days. It is assumed that this native fish stocking program will not be affected by CHD.	None anticipated
Boneyard Creek	See above	See above	None	None anticipated	None anticipated
North East Fork Black River	See above	See above	None	None anticipated	None anticipated

Source:
[1] Apache-Sitgreaves National Forest: Recreational Activities. Accessed at http://www.fs.fed.us/r3/asnf/recreation/index.shtml on Feb. 15, 2006.
[2] USDA Forest Service. Biological Assessment for The Continued Implementation of the Land and Resource Management Plans for the Eleven National Forests and National Grasslands of the Southwestern Region, Appendix E: Regional Management Direction for Species and Forest Accomplishments. 2004.

EXHIBIT 6-10. SUMMARY OF RECREATIONAL IMPACTS FOR COMPLEX 3

RIVER SEGMENT	RECREATION ACTIVITIES	PAST RECREATION IMPACTS	PAST RECOVERY EFFORTS	FUTURE RECREATION IMPACTS	FUTURE RECOVERY EFFORTS
Aravaipa Creek	Unknown	Reach is not stocked; no anticipated reduction in fishing[1]	USBR installed two concrete drop fish barriers in 2001 at a cost of $3 million; barrier monitoring costs $2,000 annually[2]	None anticipated	Continued monitoring at a cost of $2,000 annually; a share of the $500,000 fund transfer amounting to $125,000 annually[2]
Gila River	Some non-trout fishing (See Exhibit 6-5)	See above	As part of the USBR consultation, this reach is monitored at an annual cost of $10,000[2]	None anticipated	Continued monitoring at a cost of $10,000 annually; a share of the $500,000 fund transfer amounting to $125,000 annually[2]
Deer Creek	Unknown	See above	None	None anticipated	None anticipated
Turkey Creek	Unknown	See above	None	None anticipated	None anticipated

Source:
[1] Personal communication with Kirk Young, Arizona Game and Fish, Feb. 13, 2006
[2] 02-21-90-F-0119a; personal communication with Rob Clarkson, Bureau of Reclamation, Feb. 14, 2006.

EXHIBIT 6-11. SUMMARY OF RECREATIONAL IMPACTS FOR COMPLEX 4

RIVER SEGMENT	RECREATION ACTIVITIES	PAST RECREATION IMPACTS	PAST RECOVERY EFFORTS	FUTURE RECREATION IMPACTS	FUTURE RECOVERY EFFORTS
Eagle Creek	In Apache-Sitgreaves National Forest, common recreational activities include hiking, camping, fishing, and OHV use[1]	Formerly stocked; is no longer stocked, in part, due to native fish considerations; Gila Trout is now stocked as part of a recovery effort for the species[3]	None	If Gila trout is upgraded to threatened status, these reaches may become available for recreational fishing. No future impacts on angling anticipated due to CHD.	None anticipated
Blue River	See above	See above	None	See above	USBR plans to install a fish barrier costing $1.5 million by 2015[3]; barrier will cost $2,000 annually to monitor[4]
Campbell Blue Creek	See above	See above	None	See above	None anticipated
Little Blue Creek	See above	See above	None	See above	None anticipated
San Francisco River	See above; in Gila National Forest, recreational activities include hiking, camping, fishing, and OHV use[2]	None	NMGFD has spent $30,000 annually to monitor 8 sites in the Gila-San Francisco drainage and $15,000 to analyze monitoring data[5]	None anticipated	It is expected that monitoring will continue in the future at the same cost[5]
Tularosa River	See Gila National Forest above	None	See above	None anticipated	See above
Whitewater Creek	See above	None	See above	None anticipated	See above
Negrito Creek	See above	None	See above	None anticipated	See above
Frieborn Creek	See above	None	None	None anticipated	None anticipated
Pace Creek	See above	None	None	None anticipated	None anticipated
Dry Blue Creek	See above	None	None	None anticipated	None anticipated

Source:
[1] Apache-Sitgreaves National Forest: Recreational Activities. Accessed at http://www.fs.fed.us/r3/asnf/recreation/index.shtml on Feb. 15, 2006.
[2] Gila National Forest: Recreational Activities. Accessed at http://www2.srs.fs.fed.us/r3/gila/recreation/ on Feb. 15, 2006.
[3] Personal communication with Kirk Young, Arizona Game and Fish, Feb. 13, 2006
[4] Personal communication with Rob Clarkson, Bureau of Reclamation, Feb. 14, 2006.
[5] Written communication with David Propst, New Mexico Department of Game and Fish, Feb. 20, 2006.

EXHIBIT 6-12. SUMMARY OF RECREATIONAL IMPACTS FOR COMPLEX 5

RIVER SEGMENT	RECREATION ACTIVITIES	PAST RECREATION IMPACTS	PAST RECOVERY EFFORTS	FUTURE RECREATION IMPACTS	FUTURE RECOVERY EFFORTS
Upper Gila	In Gila National Forest, recreational activities include hiking, camping, fishing, and OHV use[1]	Trout and warmwater species used to be stocked in the past; stocking was discontinued because streams provided only marginal habitat for coldwater species; spikedace and loach minnow did not influence decision to cease stocking[2]	NMGFD has spent $30,000 annually to monitor 8 sites in the Gila-San Francisco drainage and $15,000 to analyze monitoring data[2]	Possibility of closing roads if they are causing adverse effects to listed species.[3]	It is expected that monitoring will continue in the future at the same cost.[2]
Middle Fork Gila	See above	See above	See above	See above	In addition to monitoring, NMDGF is considering mechanical removal of non-native species in the three Gila Forks, costing $30,000 per year for 4 years, as well as systematic inventory of these three reaches, costing $20,00 per year for 3 years. [2]
West Fork Gila	See above	See above	See above	See above	See above. In addition, NMDGF is in the early stages of designing a barrier on Little Creek, a West Fork Gila tributary. Barrier is expected to cost between $500,000 and $750,000. [2]
East Fork Gila	See above	Stream currently stocked with approximately 5,000 rainbow trout annually. [2]	See above	Potential discontinuing of stocking. Potential loss of 260 annual angler use days at a total annual cost of $16,003. [4]	See Middle Fork Gila

Source:
[1] Gila National Forest: Recreational Activities. Accessed at http://www2.srs.fs.fed.us/r3/gila/recreation/ on Feb. 15, 2006.
[2] Written communication with David Propst, New Mexico Department of Game and Fish, Feb. 20, 2006.
[3] Written communication with Jerry Monzingo, Gila National Forest, Jan. 20, 2006.
[4] If stream ceases to be stocked, it would likely be because stocking is no longer justifiable on a cost/benefit basis. Written communication with David Propst, New Mexico Department of Game and Fish, Feb. 20, 2006.

CHAPTER 7 | POTENTIAL ECONOMIC IMPACTS TO RESIDENTIAL AND COMMERCIAL DEVELOPMENT

184. Some private lands in proposed CHD are or may become developed for residential or commercial uses. Construction of residential and commercial properties may cause riparian habitat loss, siltation, and degradation that could adversely affect spikedace and loach minnow proposed CHD.[156] Real estate development also increases demand for domestic, commercial, and industrial water use, transportation infrastructure, and recreational opportunities; each of these activities is addressed elsewhere in this report.

185. This section focuses on recent and planned residential development activities on private lands in the vicinity of CHD to determine whether they have been or will be affected by conservation efforts for the spikedace and loach minnow and their habitat.

7.1 SUMMARY OF ECONOMIC IMPACTS

186. This analysis examines past and future economic impacts on residential and commercial real estate development resulting from spikedace and loach minnow conservation efforts. Spikedace and loach minnow conservation efforts are anticipated to affect new construction within proposed CHD areas rather than existing developments. For example, one past consultation on southwestern willow flycatcher and spikedace and loach minnow resulted in mitigation costs of $4.4 to $4.8 million to the developer, of which approximately $155,000 are attributed to spikedace and loach minnow.

187. By integrating the population, ownership, and geographic characteristics of the CHD stream reaches, the analysis defines the potential for future residential and commercial development in the proposed CHD. This information suggests that the most likely location for development activities in spikedace and loach minnow critical habitat is along the lower Verde River segment, which contains a large amount of private land, relatively large current population, and high projected population growth potential in the next 20 years.[157] Of 1,190 parcels that intersect proposed CHD, half (49 percent) currently contain at least one structure.[158] Future development projections on parcels

[156] For example, see "Candidate and Listing Priority Assignment Form" for Loach Minnow, Service, Phoenix Ecological Services Office, August 2004.

[157] Yavapai County GIS data, 2004 Building footprints (build04.shp), 1992 Parcels data (parcels.shp). Written communication with K. Blake, GIS Coordinator, Yavapai County, March 8, 2006.

[158] Yavapai County GIS data, 2004 Building footprints (build04.shp), 1992 Parcels data (parcels.shp). Written communication with K. Blake, GIS Coordinator, Yavapai County, March 8, 2006.

within proposed CHD are not available.[159] Given growth projections, this analysis assumes that proposed CHD areas will be built out to their maximum zoning potential within the next 20 years.[160] Six hundred and seven structures already occur on parcels that fall in proposed CHD and 1,646 additional structures are estimated to be allowable by zoning. Future costs on the Verde River segment associated with spikedace and loach minnow conservation and development are estimated to range from $3.4 million to $5.2 million over the next 20 years, assuming a seven percent discount rate ($6.4 to $9.8 million in undiscounted dollars).

188. Actual conservation requirements undertaken by an individual landowner will depend on how much of a parcel crosses proposed CHD and the extent to which development activities can be planned around sensitive areas. In addition, individual single-family home development has not historically been subject to consultation or habitat conservation plan requirements in Arizona.

7.2 ANALYTICAL APPROACH

189. Because of its riparian nature, proposed CHD for spikedace and loach minnow generally falls within the FEMA 100-year floodplain. This analysis evaluates the likelihood of development activity occurring in the floodplain area on private lands in proposed CHD areas.

190. Several regulatory programs affecting the construction of new development activities frequently involve Federal permits or funding. The most common of these programs involve the USACE, the Environmental Protection Agency (EPA), and the Federal Emergency Management Agency (FEMA). The USACE issues permits for private activities that involve modifying navigable waterways and/or wetlands for construction and maintenance of structures.[161] EPA's National Pollutant Discharge Elimination System (NPDES) permit program regulates point source pollution into the waters of the United States.[162] EPA's Phase II NPDES Storm Water Program (published December 8, 1999), requires permit coverage for storm water discharges from "construction activity disturbing between 1 and 5 acres of land (i.e., small construction activities)."[163] Although the EPA program has been delegated to the State of Arizona for management, the NPDES

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[159] Personal communication with E. Link, Yavapai County Development Services, February 16, 2006; Personal communication with A. Sanchez, Yavapai County Flood Control District, February 17, 2006; Personal communication with G. Gaylord, Cottonwood Planning Department, January 27, 2006; N. Buckel, Camp Verde Planning Department, February 13, 2006.

[160] Because some private parcels may not develop to the maximum potential allowed by zoning, this may lead to an overestimate of potential costs due to spikedace and loach minnow conservation activities.

[161] ACOE issues four types of permits: (1) individual permit, a type of standard permit requiring public comment; (2) letter of permission (LOP), a type of standard permit requiring coordination with adjacent property owners; (3) nationwide permits, which authorize a category of activities and are issued for individual small projects across the Unites States; and (4) regional or general permits, which authorize a category of activities in a specific region.

[162] Accessed at http://cfpub2.epa.gov/npdes/statestats.cfm?program_id=45&view=specific on August 30, 2002.

[163] Accessed at http://cfpub.epa.gov/npdes/stormwater/swphase2.cfm?program_id=6 on August 30, 2002.

permitting process is nonetheless considered a Federal permit. Finally, FEMA guidelines apply to development activity that fall within the 100-year floodplain.

191. Potential modifications to land use projects stemming from spikedace and loach minnow conservation activities could affect landowners, consumers, and real estate markets in general. The total economic impact depends on the scope of spikedace and loach minnow conservation activities, pre-existing land use and regulatory controls in the region, and the nature of regional land and real estate markets.

192. FEMA regulations and local ordinances do not preclude development on private lands within the proposed CHD. In general, existing regulations do aim to minimize obstructions within the floodplain that might otherwise result from unregulated development. Thus, there is theoretical potential for development activities to occur in many areas of proposed CHD. However, due to their rural nature, many areas included in the designation are not likely to experience development in the foreseeable future. This analysis identifies areas that are most likely to be impacted by future residential and commercial development using the following metrics:

- **Presence of private lands.** Land ownership GIS data is used to identify the linear overlap of private lands with proposed CHD, as well as the number of proposed acres on private lands.
- **Number of nearby communities.** GIS data containing spatial locations of communities (i.e., census designated places (CDPs) and incorporated areas) is used to identify communities that fall within 10 miles of proposed CHD, termed "nearby communities."
- **Population of nearby communities.** State census estimates of population in nearby communities in 2000 are totaled to provide a total population estimate within 10 miles of proposed CHD. These estimates do not include estimates for population located outside of CDPs or incorporated areas.
- **Projected population growth in nearby communities.** The projected percent increase in population growth in nearby communities between 2005 and 2025 is identified using state census data.
- **Presence of regulations limiting development in CHD areas.**

7.3 PAST ECONOMIC IMPACTS

193. One past section 7 consultation addressed a development project and potential impacts to the spikedace and loach minnow on the lower Verde River in Yavapai County, Arizona.[164] The consultation focused on the issuance of a NPDES permit for the Homestead at Camp Verde master planned community in Arizona, a proposed community of 800 single-family residential units and 300 apartment units on 363 acres. The consultation was issued for protection of the southwestern willow flycatcher, then

[164] U.S. Fish and Wildlife Service, Biological Opinion Harvard Homestead (2-21-01-F-148), December 26, 2001.

was amended to include the spikedace and loach minnow. To ensure that the action would not adversely affect the spikedace and loach minnow, the following measures were added:

- developing a recreation and habitat monitoring plan
- monitoring effects of recreation on habitat
- implementation of measures to ensure that habitat and streambanks are not degraded
- reducing risk of exotic species reintroduction through educational programs, prohibiting backyard ponds, and prohibiting fishing and in-stream recreation in the 25-acre Conservation Area on the property
- improving human barriers to entrance to the river area and preventing trespass
- increased fence maintenance[165]

194. The developer for this project stated that 95 percent of costs to accommodate threatened and endangered species stemmed from southwestern willow flycatcher needs.[166] Total costs for threatened and endangered species conservation efforts are estimated at $4.4 to $4.8 million. These costs associated with this project were included in cost estimates for southwestern willow flycatcher CHD. Costs to the Homestead project of conservation efforts for the spikedace and loach minnow are estimated to be $155,000. However, the Service states that this project did not go forward, and that the property has since been sold.[167] Thus, it is unclear to what extent these costs were incurred. A summary of costs associated with the Homestead Project are presented in Exhibit 7-1.

[165] U.S. Fish and Wildlife Service, Biological Opinion Harvard Homestead (2-21-01-F-148), December 26, 2001.

[166] Personal communication with D. Zuber, Harvard Investments, September 21, 2004.

[167] Written communication with Service, Phoenix Ecological Services Office, April 8, 2006.

EXHIBIT 7-1. PAST PROJECT MODIFICATION COSTS

PROJECT MODIFICATION	TOTAL COST FOR T&E SPECIES CONSERVATION EFFORTS	SPIKEDACE AND LOACH MINNOW CONSERVATION COSTS
Fencing	$100,000	$5,000
Educational materials for homeowners	$200,000	$10,000
Scientific studies over 20 years	$2,000,000	$100,000
Surveying and monitoring over 20 years	$800,000	$40,000
Off-setting mitigation (habitat set-aside)	$1,320,000 to $1,650,000	$0
Cowbird trapping program	$25,000	$0
Total	**$4,445,000 to $4,775,000**	**$155,000**

Source: Personal communication with D. Zuber, Harvard Investments, September 21, 2004. Harvard Investments states that 95 percent of costs associated with this project were due to conservation requirements for the southwestern willow flycatcher. Off-setting mitigation and cowbird trapping costs are measures specifically included for the flycatcher, and thus are not allocated to spikedace and loach minnow. Costs associated with this project were included in the economic analysis of Southwestern willow flycatcher CHD. The Service states that this project did not go forward, and that the property has since been sold. Thus, it is unclear to what extent these costs were incurred. Written communication with Service, Phoenix Ecological Services Office, April 8, 2006.

7.4 POTENTIAL FUTURE ECONOMIC IMPACTS

195. Developers may undertake conservation measures to accommodate the spikedace and loach minnow in the future similar to those undertaken for the Homestead project at Camp Verde. The economic indicators summarized below are used to identify areas where growth, and therefore commercial and residential development, is likely to occur in the vicinity of proposed CHD areas:

- **Presence of private lands.** Fifteen of the 25 river segments in proposed CHD contain private lands. Approximately 14,000 acres of private lands exist within proposed CHD (35 percent of proposed CHD). Three of the longest proposed river segments contain the most private land acres in CHD: Verde River (2,900 acres), Upper Gila River (2,700), and San Francisco River (2,600 acres). Four river segments contain less than one river mile in linear length and less than 100 acres of private land in proposed CHD (Negrito Creek, Whitewater Creek, Campbell Blue Creek, Middle Fork Gila River).
- **Number of nearby communities.** Twenty-six communities fall within 10 miles of proposed CHD. Nearly half of these communities are found near the lower Verde River Reach (12 communities). The remaining 14 communities are distributed

among six river segments: Aravaipa Creek (1), Gila River (3), San Pedro River (2), San Francisco (3), and Upper Gila River (2), East Fork White River (3).[168]

- **Population of nearby communities.** Total population of communities nearby proposed CHD was 94,000 in 2000, of which 57,000 resided in the 12 communities nearby the lower Verde River segment (60 percent of total population). Total population on the Gila River was second largest, at 20,000. Population on the San Francisco River was 4,800, and remaining river segments had populations of less than 2,000 (Aravaipa, San Pedro, and Upper Gila).
- **Projected population growth in nearby communities.** The projected population change in communities nearby CHD between 2005 and 2025 ranges from 7 percent to 49 percent. The area with the highest projected population increase is the Verde River segment. Population projections by community are presented in Exhibit 7-2.

[168] The three communities on the East Fork White River within 10 miles of proposed CHD are on White Mountain Apache lands. Potential impacts to the White Mountain Apache are discussed in Section 8.

EXHIBIT 7-2. POPULATION PROJECTIONS FOR COMMUNITIES NEARBY PROPOSED CHD FOR THE SPIKEDACE AND LOACH MINNOW

COMPLEX	RIVER SEGMENT	NEARBY COMMUNITIES	DISTANCE FROM CH (MILES)	2000 COMMUNITY POPULATION	PROJECTED POPULATION CHANGE (2005-2025)
1	Verde River	Camp Verde	-	9,451	52%
		Clarkdale	-	3,422	49%
		Cottonwood	-	9,179	104%
		Cottonwood-Verde Village	-	10,610	0%
		Paulden	-	3,420	n/a
		Cornville	1.49	3,335	58%
		Lake Montezuma	2.39	3,344	45%
		Jerome	3.51	329	27%
		Chino Valley	3.92	7,835	51%
		Williamson	5.59	3,776	n/a
		Pine	8.55	1,931	n/a
		Strawberry	9.65	1,028	n/a
2	East Fork	East Fork	-	880	35%
	White River	White River	0.12	5,220	42%
		Canyon Day	0.31	1,092	9%
3	Aravaipa Creek	Mammoth	6.54	1,762	7%
	Gila River	Kearny	-	2,249	18%
		Hayden	0.12	892	0%
		Florence	5.96	17,054	7%
	San Pedro River	Dudleyville	-	1,323	19%
		Winkelman	0.10	443	1%
4	San Francisco River	Clifton	-	2,596	14%
		Morenci	1.26	1,879	13%
		Reserve	0.04	387	n/a
5	Upper Gila River	Duncan	3.62	812	15%
		Virden	0.25	143	n/a

GIS analysis performed by IEc. ALRIS, Arizona State Lands Department, "places.shp" (2003); New Mexico Resource Geographic Information System (RGIS) "tgrplc00.sph," Incorporated and Census designated places Tiger 2000; Proposed CHD for the spikedace and loach minnow, USFWS, 2005.

Population projections: Arizona: July 1, 1997 to July 1, 2050 Arizona County Population Projections, Research Administration, Population Statistics Unit, Arizona. http://www.workforce.az.gov/admin/uploadedPublications/526_coproj97.xls; New Mexico: Revised Population Projections for New Mexico and Counties, July 1, 2000 to July 1, 2030 Bureau of Business and Economic Research, University of New Mexico. Released August 2002 and revised April 2004. http://www.unm.edu/~bber/demo/table1.htm.

196. By integrating the population, ownership, and geographic characteristics of the CHD stream reaches, as presented in Exhibit 7-3, the analysis defines a picture of the potential for development in the proposed CHD. This information suggests that the most likely location for development activities in spikedace and loach minnow critical habitat is along the lower portion of the Verde River segment, which contains a large amount of private land, relatively large current human population, and high projected population growth potential in the next 20 years. Consultation with local and county level planners supports this conclusion. Thus, the remainder of this section focuses on potential impacts to development activities on the Verde River segment.

EXHIBIT 7-3. SUMMARY OF ECONOMIC INDICATORS OF POTENTIAL FOR FUTURE DEVELOPMENT ACTIVITIES

COMPLEX	RIVER SEGMENT	COUNTY	STREAM LENGTH OF PRIVATE LANDS (MILES)	PRIVATE PROPERTY IN STREAM REACH (ACRES)	COMMUNITIES LESS THAN 10 MILES AWAY (NUMBER)	SUM OF POPULATION IN LOCAL COMMUNITIES	TOTAL PROJECTED POPULATION CHANGE IN AFFECTED COMMUNITIES (2005-2025)
1	Verde River	Yavapai	43	2,872	12	57,660	49%
	East Fork White River	Navajo/Apache	0	-	3	7,192	36%
3	Aravaipa Creek	Pinal/Graham	16	1,060	1	1,762	7%
	Gila River	Pinal	27	1,805	3	20,195	8%
	San Pedro River	Pinal	11	722	2	1,766	16%
4	Eagle Creek	Greenlee/Graham	16	963	-	-	
	San Francisco River	Catron/Greenlee	41	2,634	3	4,862	14%
	Tularosa River	Catron	10	636	-	-	
	Negrito Creek	Catron	1	49	-	-	
	Whitewater Creek	Catron	1	75	-	-	
	Blue River	Greenlee/Catron	8	505	-	-	
	Campbell Blue Creek	Greenlee/Catron	1	88	-	-	
5	East Fork Gila River	Catron/Grant	5	349	-	-	
	Upper Gila River	Grant/Hidalgo	41	2,706	2	955	15%
	Middle Fork Gila River	Catron	1	39	-	-	
	West Fork Gila River	Catron/Grant	3	192	-	-	
Total			224	14,693	26	94,392	

Notes: Data reflects population in the Census Tract, not the population within the critical habitat. Where stream reaches cross Census Tract boundaries, population estimates for both Tracts are listed. The Tracts may or may not be within the same County. Several stream reaches lie in the same Tract and as a result have the same population. County population projections are averaged for river segments that intersect multiple counties.

Sources: GIS analysis performed by IEc. ALRIS, Arizona State Lands Department, "places.shp" (2003); New Mexico Resource Geographic Information System (RGIS) "tgrplc00.sph," Incorporated and Census designated places Tiger 2000; Proposed CHD for the spikedace and loach minnow, USFWS, 2005.. Population projections: Arizona: July 1, 1997 to July 1, 2050 Arizona County Population Projections, Research Administration, Population Statistics Unit, Arizona. http://www.workforce.az.gov/admin/uploadedPublications/526_coproj97.xls; New Mexico: Revised Population Projections for New Mexico and Counties, July 1, 2000 to July 1, 2030 Bureau of Business and Economic Research, University of New Mexico. Released August 2002 and revised April 2004. http://www.unm.edu/~bber/demo/table1.htm.

7.4.1 COMPLEX 1: VERDE RIVER

197. This analysis estimates that 2,900 acres of private lands fall within proposed CHD on the Verde River (see Exhibit 2-2). These private lands occur primarily in the lower portion of the Verde River and within incorporated areas of several towns, including Cottonwood, Camp Verde, Clarkdale, and Paulden, Arizona. As detailed in Exhibit 7-2, most communities that fall within ten miles of proposed CHD are anticipated to experience fast population growth in the next 20 years.

198. By overlaying proposed CHD with local zoning data using GIS, this analysis estimates the acres of proposed private lands in CHD by zoning type. By applying the allowable density of construction within zoned areas, the analysis estimates the maximum number of structures that could be permitted in proposed CHD. These data are summarized in Exhibit 7-4. Of the 2,900 acres proposed, approximately 77 percent are zoned as either residential/rural 2-acre zoning (RCU) or incorporated lands (INC).

EXHIBIT 7-4. ZONING AND MAXIMUM BUILDOUT OF PRIVATE LANDS IN PROPOSED CHD

ZONE	DEFINITION	ACRES IN CHD	DENSITY ALLOWED (UNITS PER ACRE)	NUMBER OF UNITS ALLOWED BY CURRENT ZONING IN CHD
INC	Incorporated	1,261	Undefined	Unknown
RCU-2A	Residential, Rural, 2-acre zoning	942	0.5	471
PAD	Planned Area Development	128	1.2	159
R1L-18	Residential, Single Family Limited	122	2.4	296
R1-18	Residential, Single Family	121	0.2	30
R1L-35	Residential, Single Family Limited	120	2.4	291
R1L-10	Residential, Single Family Limited	58	0.6	36
R1-10	Residential, Single Family	36	4.4	155
R1-12	Residential, Single Family	27	1.2	34
R1L-70	Residential, Single Family Limited	21	4.4	93
R1-35	Residential, Single Family	21	14.5	300
R1L-175	Residential, Single Family Limited	20	3.6	74
C2-3	Commercial, General Sales and Service	2	5.8	13
	Grand Total	**2,880**		**1,646**

[1] Density in incorporated areas is not determined at this time by zoning.
Sources: Yavapai County Planning and Zoning, zoning GIS layer: zonediss.shp, published 1999; 2003 Yavapai Counting Planning and Zoning Ordinance, accessed online at http://www.co.yavapai.az.us/departments/Dev/unitspc/ordregs/zo/zoningordinance.pdf, on February 14, 2006.

199. This analysis sought confirmation from Yavapai County planning offices as well as Verde Valley city offices regarding potential future development activities in the Verde River segment of proposed CHD.[169] Planners confirmed that private lands along the Verde River generally can be developed, i.e., development is not restricted outright by regulation. However, some restrictions do exist. These include:

- Federal guidelines govern real estate development in floodplains for jurisdictions in flood-prone areas that choose to participate in the National Flood Insurance Program (NFIP), managed by the Mitigation Division of the FEMA. Communities in this program adopt FEMA's floodplain management ordinances in exchange for Federally-backed flood insurance. FEMA defines the floodplain lands as Special

[169] Personal communication with E. Link, Yavapai County Development Services, February 16, 2006; Personal communication with A. Sanchez, Yavapai County Flood Control District, February 17, 2006; Personal communication with G. Gaylord, Cottonwood Planning Department, January 27, 2006; N. Buckel, Camp Verde Planning Department, February 13, 2006.

Flood Hazard Areas and places special requirements on development within these areas. The lowest floor of all new residential buildings in the floodplain must be at or above the level of the 100-year flood, in order to qualify for FEMA-backed insurance. Non-residential buildings must be at or above the level of the 100-year flood, or be flood-proofed to that level. Using these guidelines, construction in a floodplain is possible in lower-risk locations, such as areas where the floodplain is wide.

- Within the floodplain, the "floodway" is defined as all land required to convey the 100-year flood without structural improvements and/or all land required to convey the 100-year flood without increasing water surface elevation by more than one foot at any single point.[170] FEMA does not prohibit all construction in floodways, but does require developers to obtain a "No Rise Certificate" by demonstrating that there will be no increase in water level as a result of construction. The No Rise Certificate must be certified by an engineer.[171] This development regulation may require special engineering, often making development in floodways impractical and prohibitively expensive.
- Where flood is a risk, development is generally discouraged;[172]
- A minimum building setback of 20 feet applies to all channel banks and floodways.[173]
- Within the Town of Camp Verde, development is not permitted on "meanderlands," lands with boundaries that move with the location of the river, and which have a "clouded title," where an owner does not have clear title to the land.[174]

[170] The floodway is the part of a waterway where water is likely to be fastest and highest, and it is therefore important that the floodway be kept free of obstructions in order to avoid increasing the water level.

[171] Personal communication with A. Sanchez, Yavapai County Flood Control District, February 17, 2006

[172] Personal communication with E. Link, Yavapai County Development Services, February 16, 2006.

[173] Drainage Criteria Manual, Yavapai County Flood Control District, Flood Damage Prevention Ordinance: http://www.co.yavapai.az.us/departments/dev/div/fcd/DSHome_FLOOD.asp

[174] N. Buckel, Camp Verde Planning Department, February 13, 2006.

200. Exhibit 7-5 shows a portion of the Verde River proposed CHD segment, parcel boundaries, and the existing buildings in proposed CHD. It is clear from this exhibit that this area is zoned for dense use. Of the 1,190 parcels that intersect proposed CHD, half (49 percent) currently contain at least one structure.[175] Future development projections on parcels within proposed CHD are not available.[176] Thus, this analysis currently assumes that each parcel that intersects proposed CHD will be built out to its maximum zoning potential within the next 20 years.[177] Because 607 structures already occur on parcels that fall in proposed CHD, 1,646 additional structures are estimated to be allowable by zoning. This would represent growth somewhat faster than expected by the cities and towns in this area. This calculation is detailed in Exhibit 7-7.

201. As described above, a small percentage of overall conservation costs undertaken for the Homestead Project specifically aimed to benefit the spikedace and loach minnow. However, some mitigation that was undertaken for the southwestern willow flycatcher in the Homestead project likely benefited the spikedace and loach minnow. Thus, in future projects where the flycatcher is not involved, more extensive fencing, monitoring, and surveying requirements could be required for spikedace and loach minnow. It is also conceivable that off-setting mitigation could be required absent flycatcher, though no past example of this exists for the spikedace and loach minnow. Thus, this analysis uses the Homestead cost estimates (for all threatened and endangered species) as a basis for estimating future costs associated with development activities. Costs to developers are assumed to range from $3.1 to $4.8 million per large development, or approximately $3,900 to $6,000 per housing unit. Low end costs include estimated costs associated with fencing, educational materials, scientific studies, and survey and monitoring. High end costs include low end costs as well as off-site mitigation costs. These per-project and per-unit housing cost estimates are detailed in Exhibit 7-6.

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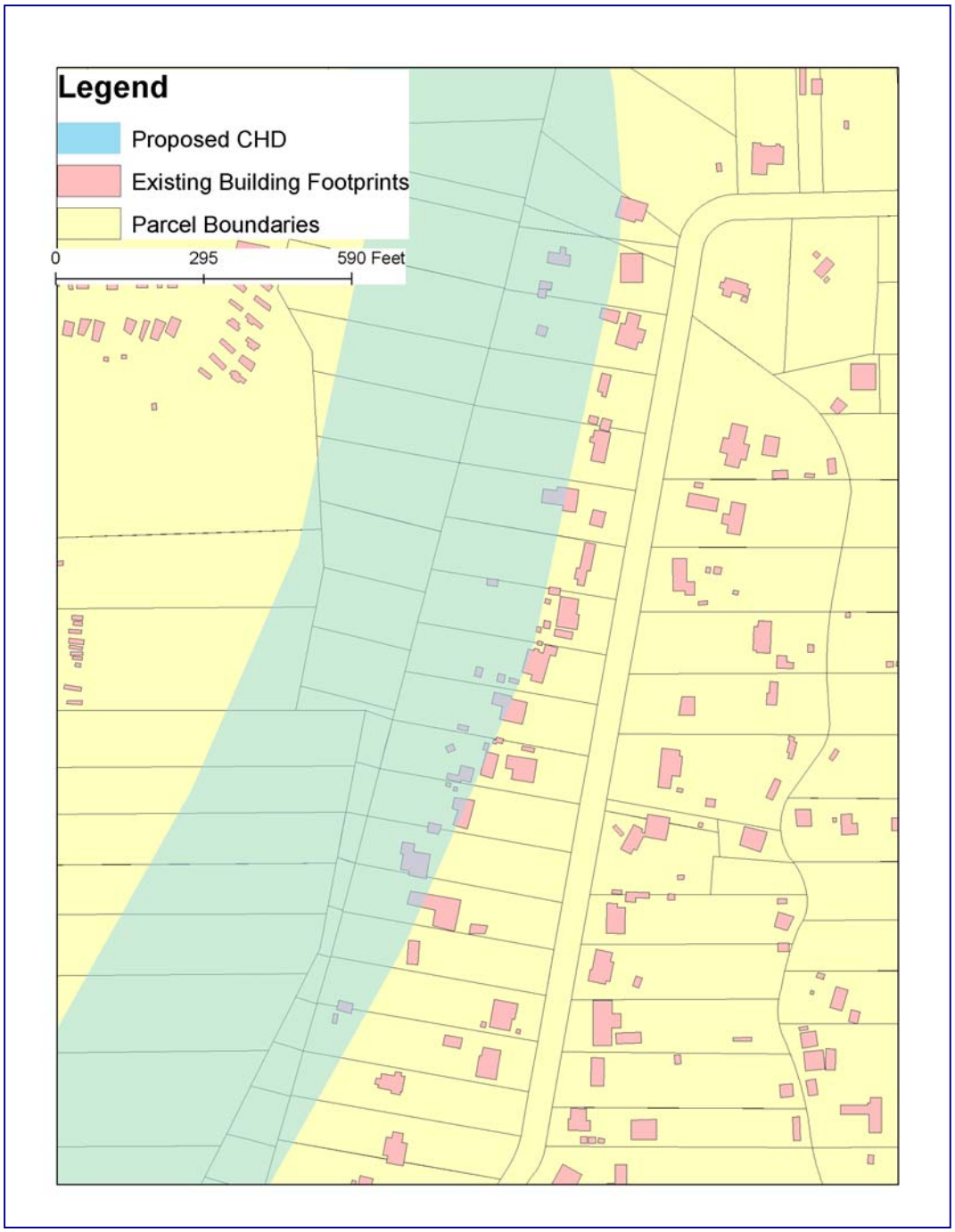
[175] Yavapai County GIS data, 2004 Building footprints (build04.shp), 1992 Parcels data (parcels.shp). Written communication with K. Blake, GIS Coordinator, Yavapai County, March 8, 2006.

[176] Personal communication with E. Link, Yavapai County Development Services, February 16, 2006; Personal communication with A. Sanchez, Yavapai County Flood Control District, February 17, 2006; Personal communication with G. Gaylord, Cottonwood Planning Department, January 27, 2006; N. Buckel, Camp Verde Planning Department, February 13, 2006.

[177] Because some private parcels may not develop to the maximum potential allowed by zoning, this may lead to an overestimate of potential costs due to spikedace and loach minnow proposed CHD.

EXHIBIT 7-5. EXAMPLE AREA ALONG PROPOSED VERDE RIVER SEGMENT SHOWING PARCELS AND EXISTING BUILDINGS



Sources: Yavapai County zoning GIS layer: zonediss.shp, published 1999; Yavapai County 1992 Parcels data: parcels.shp; Yavapai County GIS data, 2004 Building footprints (build04.shp). Written communication with K. Blake, GIS Coordinator, Yavapai County, March 8, 2006.

EXHIBIT 7-6. ESTIMATED PER PROJECT COSTS TO DEVELOPMENT ACTIVITIES WITHIN PROPOSED CHD

COST TYPE	LOW	HIGH
Per Project Costs		
Fencing	$100,000	$100,000
Educational materials for homeowners	$200,000	$200,000
Scientific studies over 20 years	$2,000,000	$2,000,000
Surveying and monitoring over 20 years	$800,000	$800,000
Off-setting mitigation (habitat set-aside)	$0	$1,650,000
Total per project costs (large development)	**$3,100,000**	**$4,750,000**
Estimated project costs per housing unit*	**$3,900**	**$5,900**

Notes: Low end costs include fencing, educational materials, scientific studies, and survey and monitoring. High end costs include low end costs as well as off-site mitigation costs.
*Estimates are developed from costs associated with the 800-unit Homestead Project (estimate does not distribute costs among the additional 300 condo units). As such, per-unit costs are distributed across 800 units.
Source: Personal communication with D. Zuber, Harvard Investments, September 21, 2004.

202. As detailed in Exhibit 7-7, future costs associated with spikedace and loach minnow conservation are estimated to range from $6.4 million to $9.8 million (undiscounted dollars).

EXHIBIT 7-7. SUMMARY OF POTENTIAL COSTS TO DEVELOPMENTS ASSOCIATED WITH SPIKEDACE AND LOACH MINNOW CONSERVATION EFFORTS IN THE VERDE RIVER SEGMENT (UNDISCOUNTED DOLLARS)

ZONE	MAX NUMBER UNITS ALLOWED IN PROPOSED CHD	NUMBER OF BUILDINGS IN PARCELS THAT INTERSECT CHD	ESTIMATED NUMBER OF UNDEVELOPED UNITS IN CHD	TOTAL POTENTIAL COSTS[1]	
				LOW	HIGH
RCU-2A	471	49	422	$ 1,636,000	$ 2,506,000
R1L-35	159	40	119	$ 461,000	$ 706,000
R1L-18	296	54	242	$ 937,000	$ 1,436,000
R1L-175	30	2	28	$ 109,000	$ 168,000
R1-18	291	58	233	$ 901,000	$ 1,381,000
R1L-70	36	13	23	$ 88,000	$ 135,000
R1L-10	155	22	133	$ 516,000	$ 791,000
R1-35	34	12	22	$ 85,000	$ 131,000
R1-10	93	45	48	$ 187,000	$ 287,000
PAD	300	-	300	$ 1,163,000	$ 1,782,000
R1-12	74	6	68	$ 265,000	$ 406,000
C2-3	13	5	8	$ 30,000	$ 46,000
INC	Unknown[2]	301	Unknown	Unknown	Unknown
Total	**1,952**	**607**	**1,646**	**$ 6,379,000**	**$ 9,774,000**

[1] Assumes per unit cost of $3,900 for low estimate, and $5,900 for high estimate (undiscounted dollars).
[2] Density in incorporated areas is not determined at this time by zoning.
Sources: Yavapai County zoning GIS layer: zonediss.shp, published 1999; Yavapai County 1992 Parcels data: parcels.shp; Yavapai County GIS data, 2004 Building footprints (build04.shp). Written communication with K. Blake, GIS Coordinator, Yavapai County, March 8, 2006. 2003 Yavapai Counting Planning and Zoning Ordinance, accessed online at http://www.co.yavapai.az.us/departments/Dev/unitspc/ordregs/zo/zoningordinance.pdf, on February 14, 2006.

SECTION 8 | POTENTIAL ECONOMIC IMPACTS TO TRIBES

8.1 INTRODUCTION

203. Lands belonging to the San Carlos Apache Tribe, Yavapai-Apache Nation, and the White Mountain Apache are included within the boundaries of the proposed spikedace and loach minnow CHD, as highlighted in Exhibit 8-1. This section provides an analysis of economic impacts associated with spikedace and loach minnow conservation activities on these Tribal lands. The administrative costs associated with section 7 consultation for activities occurring on Tribal lands are discussed in Appendix A of the report,[178] while impacts related to surveying and monitoring efforts funded by the Tribes, and project modifications associated with Tribal activities are discussed in this section.

EXHIBIT 8-1. TRIBAL LANDS IN PROPOSED CHD

COMPLEX	RIVER SEGMENT	TRIBE	STREAM MILES IN CHD ON TRIBAL LANDS	PROPOSED CHD ACRES [1]
1	Verde River	Yavapai-Apache (Camp Verde Reservation)	1	67
2	East Fork White River	White Mountain Apache (Fort Apache Reservation)	12.5	866
4	Eagle Creek	San Carlos Apache Tribe	17.2	1,133

[1] Lands of the San Carlos Apache and White Mountain Apache have been proposed for exclusion from the final CHD rule.

204. This section first provides an outline of past and future economic impacts on Tribal lands associated with the spikedace and loach minnow; it then provides information on the background and socioeconomic status of the potentially affected Tribes. Finally, this section discusses in detail the individual Tribes and projects that are potentially affected.

[178] Note that some administrative costs of compliance with ESA are unknown and are therefore not included in estimates. To the extent that these unknown administrative costs relate to spikedace and loach minnow, administrative costs estimates for the Tribes may be underestimated.

8.2 SUMMARY OF IMPACTS TO TRIBES

EXHIBIT 8-2. SUMMARY OF PAST AND POTENTIAL FUTURE IMPACTS ON TRIBES

TRIBE	COMPLEX	STREAM REACH	PAST ECONOMIC IMPACT	POTENTIAL FUTURE ECONOMIC IMPACT
Yavapai-Apache Nation	1	Verde River	Management planning document incorporates Verde River as conservation zone	Impacts on Tribal rights and Trust resources. Disproportionate impact on small Reservation: lands needed for economic development purposes, Administrative costs.
White Mountain Apache Tribe	2	East Fork White River	Management planning document incorporates spikedace and loach minnow	Impacts on Tribal rights and Trust resources, including exercise of water rights, timber, and fisheries. Impacts on economic activity, the recreation program, cultural practices, and municipal water supply, Administrative costs.
San Carlos Apache Tribe	2	Eagle Creek	Development of Fisheries Management Plan	Impacts on Tribal rights and Trust resources, water use impacts, livestock grazing impacts, fire management impacts, Administrative costs.
	3	Gila River	Administrative costs associated with proposed water exchange project	Delays/additional administrative burden associated with future proposed exchanges.

8.3 BACKGROUND AND SOCIOECONOMIC STATUS OF POTENTIALLY AFFECTED TRIBES

205. The Tribes with lands in proposed CHD are sovereign nations. Secretarial Order 3206 recognizes that Tribes have governmental authority and the desire to protect and manage their resources in the manner that is most beneficial to them. The San Carlos Apache and White Mountain Apache Tribes have their own natural resource programs and staff (the Yavapai-Apache Nation, due to its small size, does not). All three affected Tribes have enacted or are in the process of developing resource management plans, either specifically for native fish species, or for other riparian specie (e.g., the southwestern willow flycatcher). In addition, as trustee for land held by the United States for Indian Tribes, the Bureau of Indian Affairs (BIA) provides technical assistance to the Tribes on forest management planning and oversees a variety of programs on Tribal lands. The Yavapai-Apache Nation states that "it is the position of the Nation that the USFWS is

without legal authority under the ESA to designate critical habitat on the lands of the Nation."[179] The San Carlos Apache have made similar remarks in regard to other proposed CHDs.[180]

206. Given the unique characteristics of Tribal economies, the approach used to analyze potentially affected activities on Tribal lands is different than that for other types of activities. This section first provides a discussion of the current economic status of the Tribal community, and second, highlights potential impacts to Tribal activities occurring in proposed spikedace and loach minnow CHD areas.[181] Information was gathered for this analysis through several phone conversations with Tribal members, natural resources staff, and attorneys.

207. This analysis provides current socioeconomic data underscoring the conditions on the affected Reservations. Available data demonstrate the economic vulnerability of the Tribes; their economies are characterized by high unemployment, low income, low education levels and high poverty rates. In addition, the unique circumstances of communities on Tribal lands affect re-employment opportunities. For example, Tribal members who lose jobs may be less likely to move off the reservation to find work elsewhere. Thus, if spikedace and loach minnow conservation impacts job availability on the Reservations, those impacts may be compounded by poor baseline economic conditions.

208. Where information is available, the overall contribution of potentially affected activities is discussed to provide an upper bound estimate of potential impacts resulting from spikedace and loach minnow conservation activities. However, the absence of some cost information related to the potential impacts of spikedace and loach minnow conservation on Tribal lands results in a probable underestimate of future costs to Tribal entities in this section.

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[179] Letter of Susan B. Montgomery, Sparks, Tehan, and Ryley, Special Counsel to the Yavapai-Apache Nation, to Industrial Economics, Inc, "re: Information per your request regarding proposed critical habitat for the Spikedace," February 16, 2006.

[180] Public comments of Susan B. Montgomery, Sparks, Tehan, and Ryley P.C., Special Counsel to the San Carlos Apache Tribe, "Comments to Proposed Rule to Draft Environmental Assessment and Final Draft Economic Analysis of Critical Habitat for the Gila chub." September 30, 2005.

[181] This methodology is similar to that used by Dr. Joseph Kalt in his analysis of the economic impacts of critical habitat designation of the Arizona Willow on the White Mountain Apache Tribe. Economic Analysis of Proposed Designation of Critical Habitat for the Saliz Arizonica (Arizona Willow) on the Fort Apache Indian Reservation. Prepared by Professor Joseph P. Kalt. Submitted to the White Mountain Apache Tribe. April 1993. Redacted Version.

EXHIBIT 8-3. 2000 SOCIOECONOMIC INFORMATION – AFFECTED TRIBES

AREA/TRIBAL LANDS	POPULATION	UNEMPLOYMENT RATE	PER CAPITA INCOME	POVERTY RATE (1)
National Level Information				
USA	281,421,906	5.8%	$21,587	12.4%
State Level Information				
Arizona	5,130,632	5.6%	$20,275	13.9%
Tribal Level Information				
Yavapai-Apache (Camp Verde Reservation)	2,072	12.7% (2)	$8,347	33.4%
San Carlos Apache	9,385	35.4% (3)	$5,200	48.2%
White Mountain Apache (Fort Apache Reservation)	13,652	24% (4)	$6,358	48.8%

Notes:

(1) Poverty rate represents the percent of individuals below the applicable poverty threshold level. Poverty thresholds are the same for all parts of the country, but vary depending on the applicable family size, age of householder, and number of related children under 18. Poverty thresholds are shown at http://www. Census.gov/hhes/poverty/threshld/thresh99.html.

(2) Unemployment rate provided by the Census is the number of unemployed 16 and over as a percent of the total civilian force.

(3) A recent study by the San Carlos Apache Tribe found that the unemployment rate is 76 percent. Letter from Joe Sparks, Sparks, Tehan & Ryley, P.C. re: Request for Information Regarding Possible Designation of Critical Habitat for the Southwestern Willow Flycatcher, dated September 7, 2004.

(4) The WMAT unemployment rate was reported as 24 percent in 2004 by Arizona Department of Economic Security, but the Tribe states that it believes that this estimate is low. The Tribe's records indicate that unemployment hovers between 60 and 67 percent. Written comments of D. Massey Sr, Tribal Chairman, White Mountain Apache Tribe, March 27, 2006, citing information from White Mountain Apache Personnel Department, December 9, 2005 and Testimony of Chairman Dallas Massey Sr, White Mountain Apache Tribe Oversight Hearing, Regulation of Indian Gaming, June 28, 2005.

Sources: U.S. Census Bureau, Census 2000, http://censtats.census.gov/pub/Profiles.shtml.

209. The remainder of this section discusses each potentially affected Tribe individually.

8.4 YAVAPAI-APACHE NATION

210. The Yavapai-Apache Nation is located on a collection of land parcels known as Camp Verde Reservation. The 652 acres of the Reservation are distributed in parcels located near Clarkdale, Middle Verde, Camp Verde, Rim Rock, and at the I-17 interchange for the Montezuma Castle National Monument in Arizona.[182] Approximately 67 acres of the Camp Verde Reservation along the Verde River are included in the proposed spikedace and loach minnow CHD. The intersection of Camp Verde lands with proposed CHD is presented in Exhibit 8-4.

[182] Letter of Susan B. Montgomery, Sparks, Tehan, and Ryley, Special Counsel to the Yavapai-Apache Nation, to Industrial Economics, Inc, "re: Information per your request regarding proposed critical habitat for the Spikedace," February 16, 2006.

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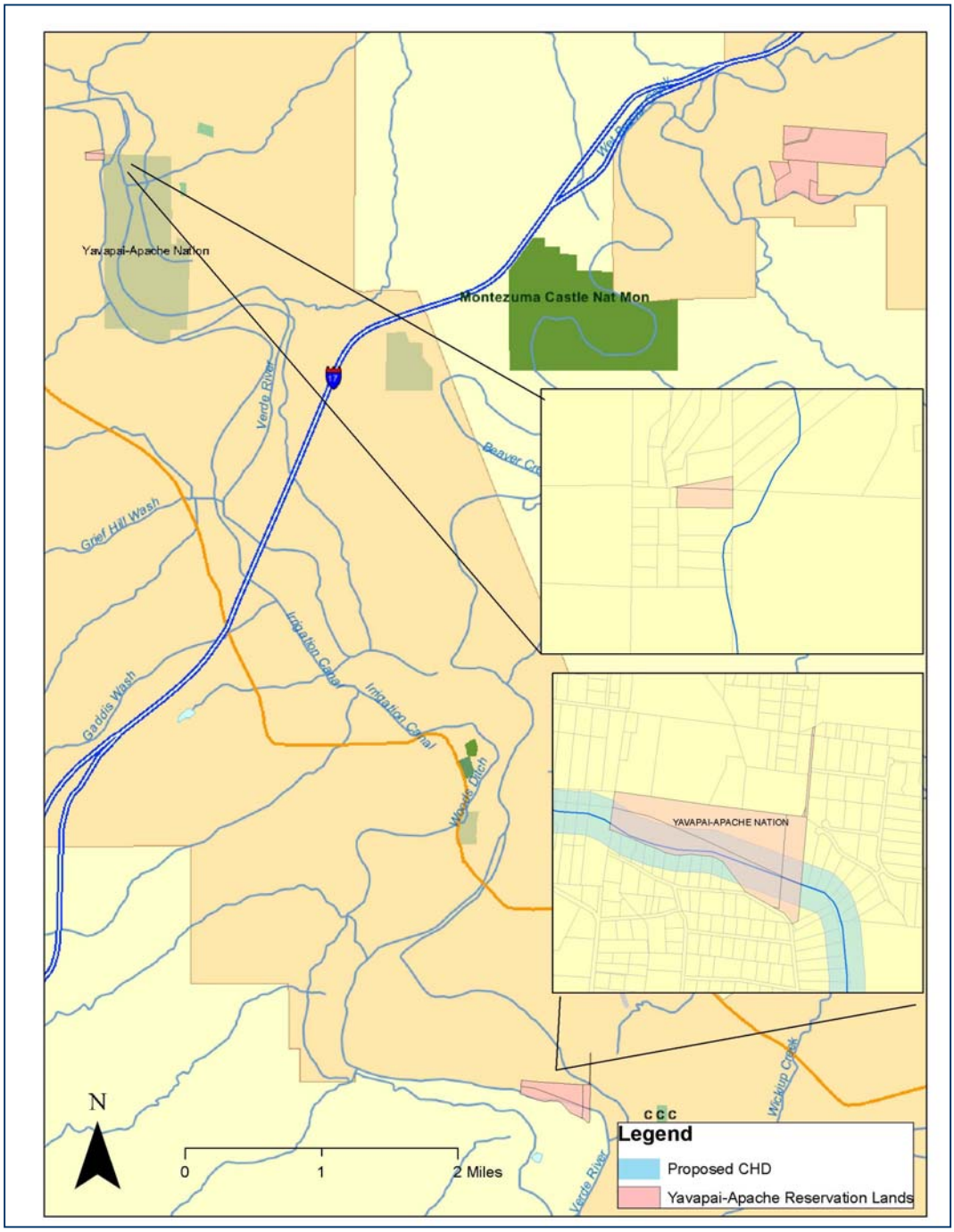
EXHIBIT 8-4. INTERSECTION OF YAVAPAI-APACHE RESERVATION LANDS WITH PROPOSED CHD



8.4.1 YAVAPAI-APACHE SOCIOECONOMIC STATUS

211. The Yavapai-Apache Nation has approximately 2,072 members, with about 1,700 members residing on the Reservation. The unemployment rate was 12.7 percent in 2000, approximately double the average for Arizona. Per capita income was $8,347 in 2000, less than half the average for Arizona. In addition, approximately 33.4 percent of the Tribe's population lives below the poverty line.[183]

8.4.2 YAVAPAI-APACHE POTENTIALLY AFFECTED ACTIVITIES

212. The Yavapai-Apache Nation opposes critical habitat designation on its lands, and states that "any designation of critical habitat on the lands of the Nation will have a disproportionate impact on the ability of the Nation to use its resources on its sovereign lands and to successfully achieve economic self-sufficiency in its Permanent Tribal Homeland."[184] Due to the small size of the Reservation, the approximately 67 acres proposed as CHD represent 10 percent of the land holdings of the Nation. With such a small reservation, the Nation needs to be able to manage its lands in such a way as to achieve economic self-sufficiency in the long term, and it is concerned that proposed CHD could hinder its management ability. As such, the Nation may wish to use proposed CHD area lands for uses such as farming, light industrial, or economic development purposes. The Nation uses the Verde River area for traditional purposes, such as willow harvesting, and also claims aboriginal and Federal Reserve water rights to the River.

213. While the Nation wants to maintain the options to use their lands as they see fit, the Tribe also states that it has historically worked to protect wildlife and the unique riparian habitat of the Verde River. Perhaps most relevant is the recent implementation of a master planning document which provides specific protections for the Verde River on the Reservation, including designating "for protection a conservation corridor on either side on the Verde River beginning at the center of the river and extending outward for approximately 500 feet."[185] The Nation also points out that it has adopted a Southwestern willow flycatcher Management Plan, which also provides protections to the riparian area on the Verde River.[186]

214. Although, future economic impacts of implementing spikedace and loach minnow conservation efforts on the Yavapai-Apache are not certain, it appears that plans for economic development could be affected by this proposed CHD, particularly given the small size of the Reservation.

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[183] Tiller, Veronica E. Velarde. "Tiller's Guide to Indian Country: Economic Profile of American Indian Reservations." Bow Arrow Publishing Company, 1996.

[184] Letter of Susan B. Montgomery, Sparks, Tehan, and Ryley, Special Counsel to the Yavapai-Apache Nation, to Industrial Economics, Inc, "re: Information per your request regarding proposed critical habitat for the Spikedace," February 16, 2006.

[185] Ibid.

[186] Ibid.

8.5 WHITE MOUNTAIN APACHE

215. The White Mountain Apache Tribe is located on the Fort Apache Reservation, a reservation of 1.7 million acres in Southeastern Arizona that abuts the San Carlos Apache Reservation. The entire reach of the East Fork White River segment (12.5 river miles) falls on the Reservation and has been proposed for exclusion. Approximately 866 acres of the Fort Apache Reservation are included in the proposed spikedace and loach minnow CHD. The intersection of White Mountain Apache lands with proposed CHD is presented in Exhibit 8-5.

8.5.1 WHITE MOUNTAIN APACHE SOCIOECONOMIC STATUS

216. The U.S. Census estimates that Fort Apache Reservation had a population of 13,652 enrolled members residing on the reservation in 2005.[187] The unemployment rate was reported as 24 percent in 2004 by Arizona Department of Economic Security, but the Tribe states that it believes that this estimate is low. The Tribe's records indicate that unemployment hovers between 60 and 67 percent.[188] The Tribe reports that "the vast majority" of employed Tribal members are employed in Tribal enterprises and governmental departments.[189] The Tribe also notes that unemployment on the Reservation has been exacerbated by the 2002 Rodeo-Chediski fire, which burned a large amount of the timber resources on the Reservation.[190] Per capita income was $3,805 in 2000, less than half the average for Arizona. In addition, approximately 48.8 percent of the Tribe's population lives below the poverty line.[191]

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[187] Information from White Mountain Apache Tribe Vital Records Department, December 9, 2005. Written comments of D. Massey Sr, Tribal Chairman, White Mountain Apache Tribe, March 27, 2006.

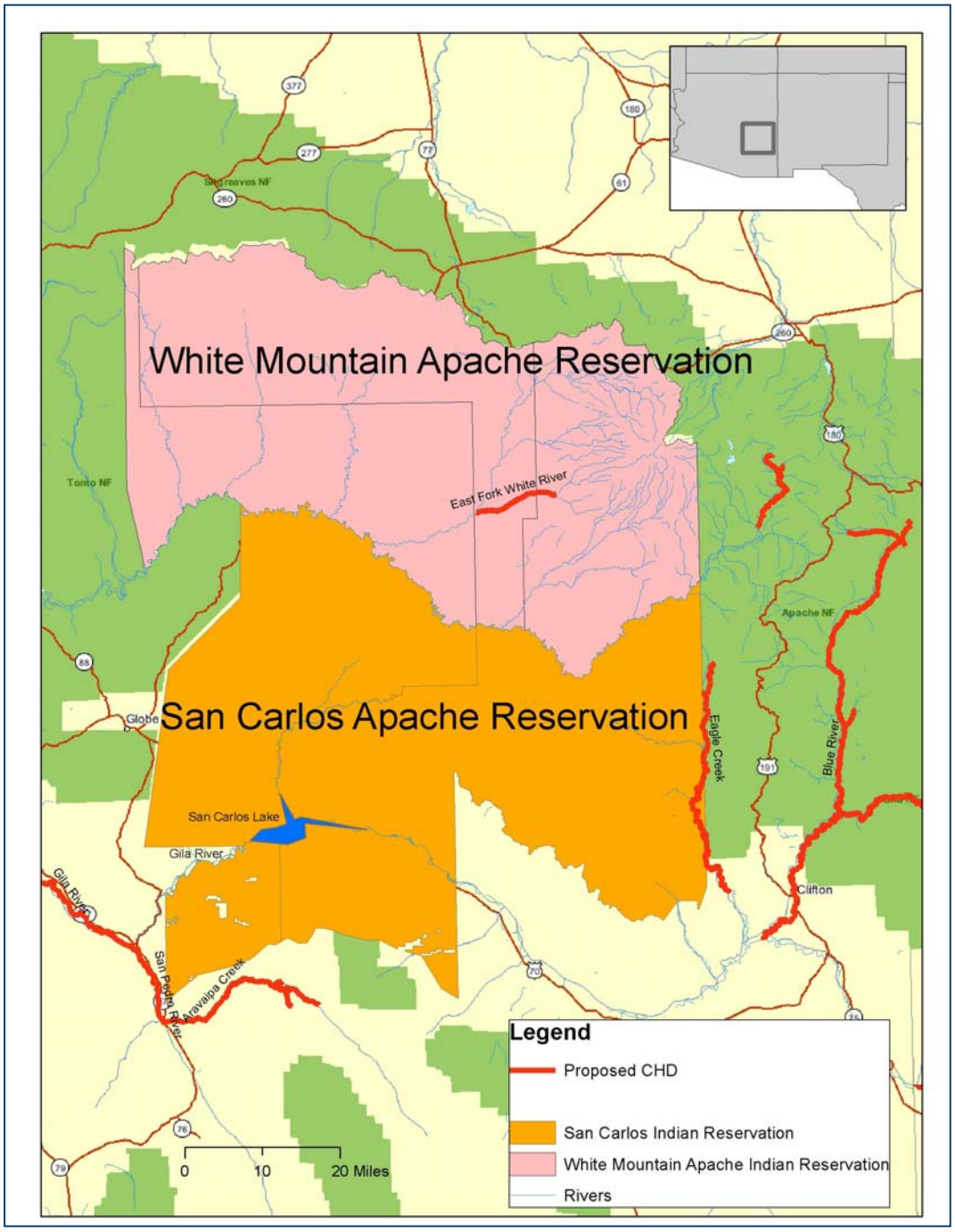
[188] Written comments of D. Massey Sr, Tribal Chairman, White Mountain Apache Tribe, March 27, 2006, citing information from White Mountain Apache Personnel Department, December 9, 2005 and Testimony of Chairman Dallas Massey Sr, White Mountain Apache Tribe Oversight Hearing, Regulation of Indian Gaming, June 28, 2005.

[189] Written comments of D. Massey Sr, Tribal Chairman, White Mountain Apache Tribe, March 27, 2006.

[190] Written comments of D. Massey Sr, Tribal Chairman, White Mountain Apache Tribe, March 27, 2006; Personal communication with A. Bernhardt, Counsel for the White Mountain Apache Tribe, and several staff members of the Wildlife and Outdoor Recreation Division, WMAT Department of Fish and Wildlife Management, April11, 2006.

[191] U.S. Census Bureau, Census 2000 and State County QuickFacts, accessed at http://quickfacts.census.gov/qfd. Unemployment data from U.S. Census Bureau, Census 2000, http://censtats.census.gov/pub/Profiles.shtml.

EXHIBIT 8-5. FORT APACHE AND SAN CARLOS APACHE RESERVATIONS



8.5.2 WHITE MOUNTAIN APACHE POTENTIALLY AFFECTED ACTIVITIES

217. In their public comment on proposed CHD, the White Mountain Apache argue that the designation of critical habitat on their lands would:[192]

- adversely impact the Tribe's working relationship with the Service and would be contrary to the government-to-government relationship that it has established with the Service for over a decade;
- not comply with the Service's affirmative trust obligation to consider Tribal reserved water rights in the context of implementation of the Act;
- undermine the Tribe's own watershed-based ecosystem management approach and result in needless diversion of resources away from the Tribe's own on-the-ground conservation efforts. Specifically, the Wildlife and Outdoor Recreation Division of the Tribe's Department of Fish and Wildlife Management point out that, in addition to having a loach minnow management plan, the Tribe has a protective water quality ordinance, water management plan, forest management plan, Arizona willow management plan, Mexican wolf management plan, and is an active member of several native fish working groups, including the Southwest Indian Fisheries Commission.[193]
- create a considerable social and economic hardship for the Tribe, limiting its ability to conduct activities necessary to sustain an economy and its growing population, particularly affecting its developing tourism and outdoor recreation industry and dependent businesses. The Tribe notes that hunting profits were $1.7 milllion in 2005, and that fishing, camping, and other outdoor recreation had profits to the Tribe of $1.3 million in 2005.[194]
- could impact potential expansion and restoration projects such as the restoration of the Fort Apache Historical District, plans to restore fruit orchards, and expansion of visitor accommodations. The orchard areas, and several planned trails will occur in proposed CHD areas. In addition, water supply to some buildings in the Fort Complex could require water from the proposed CHD stretch.[195]
- could impair the tribe's ability to conduct prescribed burns thereby increasing the likelihood of a reservation fire;

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[192] Public comments of R. Brauchli, Brauchli & Brauchli, P.C., on behalf of the White Mountain Apache Tribe, "Re: White Mountain Apache Tribe's Comments on Proposed Rule to Designate Critical Habitat for Spikedace and Loach Minnow, RIN No. 1018-AU33, 70 Fed. Reg. 75546 (December 20, 2005)," Feb. 21, 2006; Written comments of D. Massey Sr, Tribal Chairman, White Mountain Apache Tribe, March 27, 2006.

[193] Personal communication with C. Dale, Wildlife and Outdoor Recreation Division, WMAT Department of Fish and Wildlife Management, April11, 2006.

[194] Written comments of D. Massey Sr, Tribal Chairman, White Mountain Apache Tribe, March 27, 2006.

[195] Personal communication with A. Bernhardt, Counsel for the White Mountain Apache Tribe, and several staff members of the Wildlife and Outdoor Recreation Division, WMAT Department of Fish and Wildlife Management, April11, 2006.

- could affect Tribal practices that take place adjacent to the river including the Apache Sunrise Dance and sweat lodge activities as well practices dependent on culturally important vegetation that grow along the river;
- could affect "tribal rights and trust resources, including exercise of our water rights, timber, and fisheries. It could affect economic activity, our recreation program, our cultural practices, and our municipal water supply."

218. The White Mountain Apache question the legality of and the Service's authority to make such designations and argue that their Tribal lands do not meet the definition of critical habitat because they are already being adequately protected. The Tribe also states that pursuant to Executive Order 13084, the Service cannot make designations without providing funds necessary to pay the direct costs incurred by the Indian tribal government in complying with the regulation.

219. The Tribe has conducted loach minnow studies and surveys from the 1960's to the 1980s and continues to conduct loach minnow and native fish inventory and monitoring studies, including stream assessment for loach minnow habitat. Since 2000, the Tribe and the Service have worked cooperatively to implement the Tribe's loach minnow management plan.[196]

8.6 SAN CARLOS APACHE

220. The San Carlos Apache Reservation encompasses over 1.8 million acres in southeast Arizona. As shown in Exhibit 8-5, the Service has proposed for designation a 45.3 mile stretch of Eagle Creek, of which approximately 17.2 miles occur on the San Carlos Apache Reservation. The 17.2 miles of the river falling on the San Carlos Apache Reservation have been proposed for exclusion. In considering the Service's 300-foot buffer on either side of proposed critical habitat, approximately 1,100 acres of San Carlos Apache land along Eagle Creek are included in the proposed spikedace and loach minnow CHD. Because the Tribe has developed a native fish management plan, these lands have been proposed for exclusion from CHD. The following discussion provides background information on the San Carlos Apache and estimates impacts on the San Carlos Apache that could result from spikedace and loach minnow conservation efforts, should this area be included in the final CHD.

8.6.1 SAN CARLOS APACHE SOCIOECONOMIC STATUS

221. Based on U.S. Census data, the Tribe's population was 9,385 in 2000; current population is estimated at more than 12,000.[197] Based on the 2000 Census, the unemployment rate was 35.4 percent. However, a recent study by the Tribe found that the unemployment

[196] Public comments of R. Brauchli, Brauchli & Brauchli, P.C., on behalf of the White Mountain Apache Tribe, "Re: White Mountain Apache Tribe's Comments on Proposed Rule to Designate Critical Habitat for Spikedace and Loach Minnow, RIN No. 1018-AU33, 70 Fed. Reg. 75546 (December 20, 2005)," Feb. 21, 2006.

[197] Letter from Susan B. Montgomery, Sparks, Tehan & Ryley, P.C. re: Comments to Draft Economic Analysis Regarding Possible Designation of Critical Habitat for the Southwestern Willow Flycatcher on the San Carlos Apache Reservation, dated October 6, 2004.

rate is much higher, at 76 percent, indicating that at least seven out of ten people in the Tribe's labor force were unemployed.[198] San Carlos Apache per capita income was $5,200 in 2000, or about one-fifth of the Arizona average. In addition, the poverty rate on the San Carlos Apache Reservation is 48 percent. These data illustrate the vulnerability of the San Carlos Apache Tribe to economic impact or regulatory burden.

222. The San Carlos Apache Tribe's economy includes cattle operations, forestry operations, a small service sector, and tourism and recreation. The Tribe has five cattle associations and operates two Tribal ranches, although livestock numbers have decreased in recent years. The San Carlos Apache operated the Cutter sawmill outside of Globe, Arizona, but in 2000 the mill was leased to a private company, Precision Pine.

8.6.2 SAN CARLOS APACHE POTENTIALLY AFFECTED ACTIVITIES

223. As stated in the Tribe's public comments on another native fish, the Gila chub, "due to the unique Trust relationship between the United States and the Tribe, a significant number of Tribal programs, activities, and development projects require Federal government involvement, funding, or oversight. Thus…there will frequently be a Federal nexus requiring costly section 7 consultation with the [Service] for any Tribal project, activity, or development endeavor."[199] Based on conversations with Tribal staff, BIA and the Service, as well as consultation records, past and potential ongoing impacts to San Carlos Apache activities related to spikedace and loach minnow conservation efforts could include the following:

- Administrative costs of complying with the Act and preparing a Fisheries Management Plan;
- Impacts on water use by the Tribe, as well as potential water exchanges;
- Limitations on livestock use of proposed CHD for grazing and water; and
- Limitations on fire management activities.

Each of these impacts is discussed in more detail below.

Administrative Costs

224. Past costs of spikedace and loach minnow conservation activities have been limited to the development of a Draft Fisheries Management Plan in 2003 (revised September 2005) and related surveying and monitoring of the Tribe's water resources. The cost of the fish surveys and development of the Draft Fisheries Management Plan comprise past impacts related to spikedace and loach minnow conservation activities, although specific cost estimates are unavailable. The estimated cost of developing a management plan for the

[198] Letter from Joe Sparks, Sparks, Tehan & Ryley, P.C. re: Request for Information Regarding Possible Designation of Critical Habitat for the Southwestern Willow Flycatcher, dated September 7, 2004.

[199] Public comments of Susan B. Montgomery, Sparks, Tehan, and Ryley P.C., Special Counsel to the San Carlos Apache Tribe, "Comments to Proposed Rule to Draft Environmental Assessment and Final Draft Economic Analysis of Critical Habitat for the Gila chub." September 30, 2005.

southwestern willow flycatcher is estimated to be $5,000,[200] and may serve as a rough estimate of costs of developing the native fish plan.

225. Any future consultations with the Service would involve a commitment of the Tribe's limited resources. As stated in their public comments on the Gila chub proposed CHD, "Tribal governments frequently utilize special counsel as well as skilled and technical personnel within Tribal departments, like the San Carlos Recreation and Wildlife Department, when section 7 consultation is called for by the [Service] under the ESA. These 'administrative costs' are…very real costs which must be borne by the Tribe, regardless of whether the acting agency (such as the Bureau of Indian Affairs or the Bureau of Reclamation), is also participating in the section 7 consultation process." The Tribe is also unsure of the costs of implementing the Final Fisheries Management Plan.[201] If the Fisheries Management Plan adequately addresses conservation of the spikedace and loach minnow, the critical habitat designation should result in little extra administrative effort.

Water Resources

226. The Gila River flows through the San Carlos Apache Reservation from the east and pools into the San Carlos Lake behind Coolidge Dam on the western portion of the Reservation. This portion of the Gila River is not proposed as CHD. Below the Lake, the River flows out of the Reservation and intersects the San Pedro River, which is proposed as CHD, as shown in Exhibit 8-5. Further downstream, the Gila River is diverted to irrigators at Ashurst-Hayden dam, the downstream terminus of proposed CHD in Complex 3. Although the Gila River is the largest river on the Reservation, several smaller tributaries cross the Reservation, including a portion of Eagle Creek which is proposed for exclusion from CHD.

227. The Tribe is concerned that proposed CHD for spikedace and loach minnow may threaten the ability of the Tribe to utilize its water resources on the Reservation. Water use on the Reservation is generally constrained by the arid climate of the Reservation, competing water claims, as well as by the 1935 Globe Equity 59 Decree (on the mainstem Gila River). Thus any restrictions in management of Eagle Creek for spikedace and loach minnow purposes could threaten Tribal uses of this water.

228. If the amount of water available to the San Carlos Apache Tribe for irrigation were to be limited to protect the spikedace and loach minnow, the Tribe's agriculture activities would be affected. The San Carlos Apache Tribe has been farming for hundreds of years in the Gila Valley, with over 9,000 acres of land under cultivation in the late 1800s. According to the Tribe, "the Tribe now struggles to farm a fraction of these lands due to

[200] Personal communication with Stefanie White, San Carlos Apache Recreation and Wildlife Department, August 24, August 26 and September 8, 2004.

[201] Personal communication with Stefanie White, San Carlos Apache Recreation and Wildlife Department, May 25 and June 6, 2005.

the lack of a reliable water supply."[202] The San Carlos Apache Tribe currently farms 500 acres, generating approximately $135,000 in annual profits (for the period from October 2003 through July 2004) and supporting six jobs with $165,000 in payroll. The Tribe has recently invested heavily in equipment for its agricultural operations. The Tribe is looking into expanding farming, possibly beginning with adding approximately 1,000 acres.[203] While expansion plans are still uncertain, there are thousands of acres of irrigable lands on the Reservation.[204] If restrictions related to spikedace and loach minnow conservation measures impact the Tribe's ability to continue or expand farming on the Reservation, these jobs and revenues may be affected.

229. As discussed in Chapter 3, USBR consulted with the Service on a proposed exchange of up to 20,000 acre feet of CAP water by the San Carlos Apache Tribe to be supplied downstream of San Carlos Lake on the Gila River, including the designated portion in Complex 3 of proposed CHD. This biological opinion recommended that USBR undertake a variety of activities, including additional research and monitoring, installation of meters, and reporting.[205] However, the project did not take place in 2004 due to water accounting concerns that were unrelated to spikedace and loach minnow.[206]

230. The Tribe states that it is entitled to exchange its CAP water to be supplied downstream of Coolidge Dam in the future.[207] The Tribe has a legal right to conduct this exchange, which would serve multiple functions, including maintaining a minimum water level in the Lake to avoid possible fish kills and impacts on recreation and wildlife. The Tribe is concerned that the designation of CHD for the spikedace and loach minnow would further complicate an already complex and lengthy procedure for getting an exchange.[208] USBR states that this project will be reevaluated before an exchange will occur and a new consultation is likely. However, specific future recommendations of the biological opinion are uncertain.

231. If the Tribe is unable to receive its requested water exchange in a given year, water levels could drop to dangerously low levels, impacting recreation and wildlife at the Lake.[209] The San Carlos Apache derive income from a variety of recreational activities at San

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[202] Letter from Susan B. Montgomery, Sparks, Tehan & Ryley, P.C. re: Comments to Draft Economic Analysis Regarding Possible Designation of Critical Habitat for the Southwestern Willow Flycatcher on the San Carlos Apache Reservation, dated October 6, 2004.

[203] Personal communication with Victoria Wesley, Forest Resource Program, San Carlos Apache Tribe, August 30, 2004.

[204] Letter from Joe Sparks, Sparks, Tehan & Ryley, P.C. re: Request for Information Regarding Possible Designation of Critical Habitat for the Southwestern Willow Flycatcher, dated September 7, 2004.

[205] U.S. Fish and Wildlife Albuquerque Regional Office. 2004. Biological opinion on the Bureau of Reclamation's Approval of Water Exchange by the San Carlos Apache Tribe for Retention in San Carlos Reservoir, March 8.

[206] Personal communication with Susan Montgomery, Sparks, Tehan & Riley, Special Counsel to the San Carlos Apache Tribe, February 14, 2006.

[207] Ibid.

[208] Ibid.

[209] Personal communication with Susan Montgomery, Sparks, Tehan & Riley, Special Counsel to the San Carlos Apache Tribe, March 22, 2006.

Carlos Lake, including: fishing license fees, camping fees, marina and store revenues. In the past, revenues from these sources has exceeded $2 million a year. This recreational activity also supports a number of jobs on the Reservation, as well as supporting the management and law enforcement at the Lake and in the Tribal Recreation and Wildlife Department.[210] Another potential impact related to the water exchange project stems from the fact that the San Carlos Apache may have to order and pay for the delivery of CAP water well in advance, even before section 7 consultation is complete. If spikedace and loach minnow conservation activities were to affect the Tribe's ability to complete an exchange after the Tribe has already paid, the Tribe could lose the money it has paid for CAP water and never receive the benefit of stored water in the Lake. In 2005, the Tribe's cost for CAP water was $79 per acre-foot; this equates to $1.6 million for 20,000 acre-feet. [211] The Tribe anticipated that this is a potential high-end cost of southwestern willow flycatcher conservation. Similarly, it would stand to reason that this could represent a high-end cost of spikedace and loach minnow conservation as well.

Livestock Grazing

232. Livestock grazing is an important source of income for the San Carlos Apache Tribe, as large portions of San Carlos Apache lands are grazed by five livestock associations and two tribal ranches. Livestock association personnel have expressed concerns that grazing could be impacted by other proposed CHDs on the Tribe's lands.[212]

233. It is unknown what modifications or mitigation measures may be recommended to grazing activities as a result of spikedace and loach minnow concerns. If the Service recommended or the Tribe chose to implement mitigation measures, one option could be the installation of fencing along Eagle Creek to exclude livestock from the streams and adjacent riparian areas. Costs of fencing exclosures are anticipated to range from $1,500 to $15,000 per river mile of fence construction. The Tribe would also incur costs related to annual maintenance of the fencing, of approximately $110 to $2,600 per mile. In addition, if fencing were installed, water would need to be provided to livestock outside the exclosure. The cost to construct a dirt impoundment to store overland flow ranges between $2,000 and $10,000. The annual cost to maintain dirt impoundments ranges between $333 and $500.[213]

234. Without knowing the terms of the existing lease agreements, it is difficult to know who would bear the cost of fence installation in this scenario: the Tribe, the livestock associations, BIA, the Service, or some combination. Ultimately, the distinction between the Tribe and the livestock associations may not be that important, as the livestock associations are owned by, operated by, and composed of Tribal members. On non-Tribal

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[210] Letter from Joe Sparks, Sparks, Tehan & Ryley, P.C. re: Request for Information Regarding Possible Designation of Critical Habitat for the Southwestern Willow Flycatcher, dated September 7, 2004.

[211] Ibid.

[212] Personal communication with San Carlos Apache and livestock association personnel, May 25, 2005; personal communication with San Carlos Apache personnel, June 16, 2005.

[213] Ibid.

lands, Federal landowners frequently bear the costs of constructing riparian fencing, while maintenance costs may be borne by permittees.[214]

235. Despite the potential impacts on livestock activities, it appears unlikely that there will be much change in grazing effort on the San Carlos Apache Reservation as a result of proposed CHD for spikedace and loach minnow, primarily because: (1) the area of proposed critical habitat is a small percentage of the total area available for grazing to each livestock association; (2) each of the livestock associations has access to multiple water sources; and (3) the herds are of relatively small size.

Fire Management Activities

236. Under Public Law 93-638, activities related to fire management and forest health on Tribal lands are conducted by BIA and the Tribe. The Tribe has not experienced impacts to these activities in the past. However, the Tribe's goal is to have prescribed burns on the majority of reservation land every ten years. The Tribe could experience impacts in the form of restrictions on burning.[215] If the Tribe were not able to perform fire management activities as planned, the risk of catastrophic fire on Tribal lands could increase.

[214] Personal communication with Ted Cordery, BLM, Arizona State Office, July 18, 2005.

[215] Personal communication with Dee Randall, San Carlos Apache Natural Resources Department, June 16, 2005.

SECTION 9 | POTENTIAL ECONOMIC IMPACTS TO TRANSPORTATION ACTIVITIES

237. Road and bridge construction and maintenance can adversely affect spikedace and loach minnow habitat.[216] The primary problem related to these activities is sedimentation. Specifically, road construction may contribute to watershed problems through direct soil disturbance. Road construction and maintenance may increase the sediments entering the stream through normal run-off.

9.1 SUMMARY OF IMPACTS TO TRANSPORTATION ACTIVITIES

238. This analysis estimates that the total future project modification costs of consultations and conservation activities associated with road and bridge construction and maintenance will range from $1.3 million to $1.4 million over the next 20 years (undiscounted dollars). Total project modification costs for road and bridge construction and maintenance are presented by stream reach in Exhibit 9-1. Future administrative costs are estimated to range from $205,000 to $512,000 (undiscounted dollars) and are presented in Appendix A.

239. Approximately 21 major roads and low-water crossings traverse the proposed CHD 23 times. The road crossings and units in which they are contained are presented in Exhibit 9-2.

9.2 PAST ECONOMIC IMPACTS TO TRANSPORTATION ACTIVITIES

240. Eight past section 7 consultations addressing road construction or maintenance projects impacting the spikedace and loach minnow have occurred in the areas proposed for CHD. Exhibit 9-3 summarizes the project modifications associated with these past consultations. Administrative costs associated with these consultations are estimated to be $115,000 to $184,000. Details regarding these calculations are presented in Appendix A.

[216] U.S. Fish and Wildlife Service. Proposed Rule to List the Spikedace and Loach Minnow as Endangered With Critical Habitat. (70 FR 75546) December 20, 2005.

EXHIBIT 9-1. SUMMARY OF FUTURE COSTS ASSOCIATED WITH ROAD AND BRIDGE CONSTRUCTION AND MAINTENANCE, 2006-2025

AREA	STREAM REACHES	TOTAL PROJECTS	TOTAL UNDISCOUNTED DOLLARS		PRESENT VALUE (3%)		PRESENT VALUE (7%)	
			LOW	HIGH	LOW	HIGH	LOW	HIGH
Complex 1	Verde River	3	$750,000	$750,000	$558,000	$558,000	$397,000	$397,000
Complex 3	Aravaipa Creek	1	$250,000	$250,000	$186,000	$186,000	$132,000	$132,000
Complex 4	San Francisco River	2	$251,000	$300,000	$188,000	$260,000	$134,000	$185,000
	Blue River	2	$3,000	$100,000	$2,000	$74,000	$1,600	$53,000

Note: Refer to Appendix A for information regarding administrative costs associated with transportation activities. Totals may not sum due to rounding.

EXHIBIT 9-2. ROAD CROSSINGS WITHIN PROPOSED CHD FOR THE SPIKEDACE AND LOACH MINNOW

AREA	STREAM REACH	ROAD	MAJOR ROAD CROSSINGS [A]	PAST FORMAL CONSULTATIONS	PAST COSTS (UNDISCOUNTED)	FUTURE COSTS (UNDISCOUNTED)
Complex 1	Verde River	Interstate 17[b]	2	4	$0	$250,000 [f]
		State Route 260[b]	2		$0	$250,000 [f]
		State Route 89A[a]	1		$0	$250,000 [f]
Complex 3	Aravaipa Creek	State Route 77[b]	1	1	$0	$250,000[f]
	San Pedro River	State Route 77[b]	1	0	$0	
Complex 4	San Francisco River	US Highway 191[a]	1	0	$0	$250,000 [f]
		State Highway 12[a]	1	0	$0	-0-
		7 low-water crossings on a 4-wheel drive road[e]	7	1	$1,500-$50,000	$1,500-$50,000
	Whitewater Creek	US Highway 180[a]	1	0	$7,900 [f]	-0-
	Blue River	USFS Forest Road 475[c]	1	2	$1,500-$50,000	$1,500-$50,000
		USFS Forest Road 281[d]	1		$1,500-$50,000	$1,500-$50,000
Complex 5	Gila River	State Highway 15[a]	1	0	$0	-0-
		State Highway 211a	1	0	$7,900 [f]	-0-
		State Highway 92[a]	1	0	$0	-0-
		US Highway 180[a]	1	0	$7,900 [f]	-0-
Total			**23**	**8**	**$28,200-$173700**	**$1,254,500-$1,400,000**

AREA	STREAM REACH	ROAD	MAJOR ROAD CROSSINGS [A]	PAST FORMAL CONSULTATIONS	PAST COSTS (UNDISCOUNTED)	FUTURE COSTS (UNDISCOUNTED)

Sources:

[a] GIS analysis performed by IEc. GIS data for roads in Arizona and New Mexico were intersected with spikedace and loach minnow critical habitat. Source: ESRI, "Minor Highways", 2001; Spikedace and Loach minnow critical habitat GIS layer, Service, November 2005. This analysis does not include smaller county-maintained and USFS/BLM road crossings.

[b] Arizona Department of Transportation. Comments on the Designation of Critical Habitat for the Loach Minnow and Spikedace. February 14, 2000. (Public Comment)

[c] U.S. Fish and Wildlife Service. Biological Opinion for Repair of Blue River Low-Water Crossing on Forest Road 475 with 404 Permit, Apache-Sitgreaves National Forests. April 21, 1995. (2-21-95-F-166)

[d] U.S. Fish and Wildlife Service. Blue River Roads, Emergencies, and BMPs, Interim Biological Opinion. June 16, 1997. (2-21-94-F-243)

[e] U.S. Fish and Wildlife Service. Biological Opinion for Repair and Maintenance of a 4-Wheel Drive Road on the Lower San Francisco River. April 15, 1997. (2-21-96-F-233)

[f] The estimate of $23,707.60 for spikedace and loach minnow-related costs is for a project that spanned three road crossings within proposed CHD. This number was divided evenly over the three road crossings listed above. Written communication with R. Morgan, NM DOT, on Feb. 21, 2006.

Note: The above cost estimates do not include administrative costs. Please refer to Appendix A for a detailed description of administrative costs.

EXHIBIT 9-3. PAST PROJECT REQUIREMENTS FROM SECTION 7 CONSULTATIONS FOR TRANSPORTATION ACTIVITIES ASSOCIATED WITH THE SPIKEDACE AND LOACH MINNOW

Minimize Direct Mortality

- In addition to the provisions of the BMPs, all reasonable efforts shall be made to minimize activities within the wetted channel. (a, b, c, d)
- Except during emergency situations, all work requiring entry of vehicles or equipment into surface water will not be conducted during loach minnow spawning season. (a, b, c)
- All reasonable efforts shall be made to ensure that no pollutants enter surface waters during actions implementation. In addition, no toxic chemicals or vehicles shall be stored or deposited within the floodplain during or after construction. (a, b, c, d)

Minimize Loss and Alteration of Habitat

- All reasonable efforts shall be made to minimize damage to or loss of riparian vegetation. (a, b, c, d)
- Projects anticipated to take longer than one season to complete will require additional consultation with the Service. (a)
- Channel alteration and use of heavy equipment within the river channel and floodplain shall be limited to within 25 linear feet perpendicular to the centerline of the low-water crossing and existing roadbed. (b, d)
- Borrowing of gravel from tributary alluvial fans shall be done in a manner that generally retains the natural contours of the fans. (b)

Monitor Fish Communities and Habitat to Document Levels of Incidental Take

- All reasonable efforts shall be maintained to monitor for the presence of dead or dying fish in or within 500 yards downstream of the project areas. the Service shall be notified immediately by telephone upon detection of more than 20 dead or dying fish of any species. Operations must be stopped in the interim period between the notification and completion of a new consultation if it is determined that the impact of the additional taking will cause an irreversible and adverse impact to the loach minnow or their habitat. (a, b, c, d)

Maintain Complete and Accurate Records of Actions Which May Result in Incidental Take of Species and/or its Habitat

- A written report shall be submitted to the Service within 60 days of completion of project activities. The report shall document the project, as implemented, and shall include photographs of the project area before project initiation and after project completion. the report shall also include a discussion of compliance with the above terms and conditions. (c, d)

Sources:

(a) "Normal and flood-related maintenance for Forest Road (FR) 281," 2-21-94-F-243.

(b) "Re-initiation of biological opinion for State Route 260," 2-21-98-F-403R1.

(c) "Biological opinion on design for a permanent low-water crossing on the Blue River," 2-21-00-F-364

(d) "Emergency follow-up repair of flood damage to low-water ford crossings on Forest Road 475," 2-21-95-F-166

241. Past project modification costs associated with implementing spikedace and loach minnow conservation efforts associated with transportation projects are estimated to be $24,000.[217] These costs were borne by the New Mexico Department of Transportation to restore stream channels to their original flow lines as they approached and departed three major road crossings. The three bridges affected by this project included: Bridge #7463 on NM 211 over the Gila River, Bridge #6684 over the Gila River on US 180 northwest of Cliff, NM, and Bridge #8385 over Whitewater Creek on US 180 in Glenwood, NM.[218] These projects were not associated with a past consultation. Other project modification costs associated with past consultations are unknown.

9.3 FUTURE ECONOMIC IMPACTS ON TRANSPORTATION ACTIVITIES

242. Road crossings included in the analysis fall within the Arizona and New Mexico State Transportation System as well as in Apache-Sitgreaves National Forest.

243. Five major roads within the Arizona State Transportation System cross critical habitat:

- State Route 89A (Complex 1 -Verde River)
- State Route 260 (Complex 1 - Verde River)
- Interstate 17 (Complex 1 - Verde River)
- State Route 77 (Complex 3 - Aravaipa Creek)
- US Highway 191 (Complex 4 - San Francisco River)

According to the Arizona Department of Transportation (ADOT) 5-year bid date report, the rehabilitation of the I-17 Verde River Bridge is planned in the next five years and may impact proposed critical habitat.[219] This analysis forecasts costs to the ADOT and assumes that each major road will be subject to one maintenance project over the next 20 years (2006-2025). Future costs for these projects are based on past project modification costs incurred by ADOT for the Little Colorado spinedace ($250,000).[220] As shown in Exhibit 9-4, this project involved:

- Exclusionary Netting
- Monitoring
- Water Quality Testing
- Reporting

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[217] Written communication with Rand Morgan, Environmental Analyst for the New Mexico Department of Transportation. Received February 21, 2006.

[218] Ibid.

[219] Written communication with Justin White, NEPA Planner/Wildlife Biologist for the Arizona Department of Transportation. Received February 17, 2006.

[220] Ibid.

Total conservation efforts associated with the Little Colorado spinedace project are estimated to cost approximately $250,000. Because this project was a bridge replacement, it may represent a high-end cost of project modifications likely to be taken by ADOT.

244. The New Mexico Department of Transportation (NMDOT) does not currently have plans for projects within the proposed areas of spikedace and loach minnow critical habitat. NMDOT notes that the existing regulatory restrictions and environmental review processes already required for projects falling within these riparian areas make NMDOT District 1 reluctant to pursue needed maintenance activities. Only in the event of a bridge becoming so deficient that it presents a danger to the traveling public or in response to an emergency (i.e., a road or bridge washes out) would NMDOT District 1 likely undertake projects in areas of critical habitat.[221] Therefore, this analysis does not estimate costs associated with spikedace and loach minnow conservation activities for roads maintained by NMDOT.

245. Conservation activity costs associated with minor road construction or maintenance within Apache-Sitgreaves National Forest are assumed to range from $1,500 to $50,000 per project.[222] This cost estimate includes work outside of the stream channel and buffering against sedimentation with silt aprons as shown in Exhibit 9-4.

EXHIBIT 9-4. CONSERVATION ACTIVITIES FOR TRANSPORTATION ACTIVITIES ASSOCIATED WITH THE SPIKEDACE AND LOACH MINNOW IN ARIZONA AND NEW MEXICO

AGENCY	CONSERVATION ACTIVITY	POTENTIAL PROJECT COST RANGE
Arizona Department of Transportation [a]	Exclusionary Netting	**$250,000**
	Monitoring	
	Water Quality Testing	
	Reporting	
Forest Service Apache-Sitgreaves National Forest [b]	Work outside of stream	**$1,500-$50,000**
	Buffer against sedimentation with silt aprons	

Sources:
[a] Written communication from Justin White, Arizona Department of Transportation, February 16, 2006.
[b] Personal communication with Terry Myers, U.S. Forest Service, Apache-Sitgreaves National Forest, District Ranger, October 2002.

221 Written communication with Rand Morgan, Environmental Analyst for the New Mexico Department of Transportation. Received February 21, 2006.

222 This is based on a previous estimate provided by Apache-Sitgreaves for project modifications for road crossings within proposed critical habitat for the Gila Chub (Personal communication with Terry Myers, U.S. Forest Service, Apache-Sitgreaves National Forest, District Ranger, October 2002.) .

246. This analysis assumes that road crossings on USFS lands will incur costs of $1,500 to $50,000, while the costs of spikedace and loach minnow conservation activities for road crossings associated with state and federal highways will be approximately $250,000.

SECTION 10 | POTENTIAL ECONOMIC IMPACTS TO FIRE MANAGEMENT ACTIVITIES

247. There is little debate that there is a high risk of catastrophic wildfire in many areas of the Southwest. According to the Southwest Forest Health and Wildfire Prevention Act of 2003, 39 million acres of National Forest land in the interior west are at high risk of catastrophic wildfire.[223] In addition, the frequency and intensity of catastrophic wildfire has been increasing over time. The average size of wildfires has been increasing since 1960, and particularly since the 1970's. Reportedly, the average size of a wildfire since the 1970's is double the average size of a wildfire in the 1940s to 1960s.[224]

248. The primary contributor to the recent increases in wildland fire and intensity is widely believed to be the long-standing practice of fire suppression by USFS and other land management agencies. Logging practices and grazing activities also exacerbate impacts on the natural fire regime. These practices resulted in a reduction in the frequency of low-intensity fires that historically removed fuels from the forest floor. As a result, the number of "stand-replacing," high-intensity fires has increased.[225]

249. With the increase in stand-replacing fires has come increasing damage to private property. For example, the 2000 Cerro Grande Fire in New Mexico burned 47,650 acres, including the destruction of 235 structures and part of Los Alamos National Laboratory.[226] The 468,638-acre Rodeo-Chediski fire of 2002 ranks as Arizona's second most expensive disaster ever, with insurance companies paying out over $102 million for the destruction of 426 structures (including 250 homes).[227] As a result of the increased risk and cost of catastrophic wildfires, both the public and the land management agencies have an interest in implementing fuel reduction and fire management efforts. Fire management activities may impact the spikedace and loach minnow and proposed CHD areas. Various agencies and private parties may conduct fire management activities within proposed CHD.

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[223] H.R. 2696, July 10, 2003.

[224] "Wildfire history and ecology," http://www.cpluhna.nau.edu/Biota/wildfire.htm, accessed February 17, 2004. National Interagency Fire Center, Wildlands Fire Statistics, 1960-2002, www.nifc.gov/stats/wildlandfirestats.html, accessed February 16, 2004.

[225] Ibid.

[226] National Interagency Fire Center, Historical Wildland Fire Statistics, ww.nifc.gov/stats/historicalstats.html, accessed February 16, 2004.

[227] Wichner, David. "Rodeo-Chediski Costs Rank 2nd," *Arizona Daily Star*, July 16, 2002.

10.1 BACKGROUND AND SUMMARY OF PAST FIRE MANAGEMENT IMPACTS

250. Spikedace and loach minnow conservation activities have had limited impacts on fire management activities in the past. Two consultations on fire management have been completed to date that addressed the spikedace and loach minnow. The first consultation was the BLM Arizona Statewide Land Use Plan Amendment for Fire, Fuels, and Air Quality Management.[228] The second was completed for prescribed burning efforts on the Robinson Mesa Prescribed Fire project.[229] Conservation activities for the spikedace and loach minnow are described in Exhibit 10-1.

251. During the Three-Forks fire in Apache-Sitgreaves National Forest in 2004, the Forest Service considered evacuation of spikedace and loach minnow. However, upon finding two fish, it was determined that the best course of action for the local population was to return the fish to the stream channel rather than risk harm or loss of species through transportation, quarantine, and holding.[230] There have been no previous spikedace or loach minnow evacuations at Prescott or Gila National Forests.[231]

EXHIBIT 10-1. CONSERVATION ACTIVITIES FOR FIRE MANAGEMENT ASSOCIATED WITH THE SPIKEDACE AND LOACH MINNOW

CONSULTATION	PROJECT MODIFICATIONS
BLM Statewide Land Use Plan Amendment for Fire, Fuels, and Air Quality Management	Collect and salvage fish if incidental take is likely to occur.
	Monitor the effects of fire suppression.
	Annually report monitoring efforts.
Robinson Mesa Prescribed Fire Project on the Clifton Ranger District of the Apache-Sitgreaves National Forests	Minimize the potential for sedimentation and toxic ash to reach Eagle Creek by lining felled pine structures perpendicular to the canyon.
	Document the effectiveness of the pine structures using photo points.
Source: U.S. Fish and Wildlife Service. Biological and Conference Opinion for the BLM Arizona Statewide Land Use Plan Amendment for Fire, Fuels, and Air Quality Management. September 3, 2004. U.S. Fish and Wildlife Service; U.S. Fish and Wildlife Service. Formal Conference on the Robinson Mesa Prescribed Fire Project on the Clifton Ranger District of the Apache-Sitgreaves National Forests. October 5, 1999.	

[228] U.S. Fish and Wildlife Service. Biological and Conference Opinion for the BLM Arizona Statewide Land Use Plan Amendment for Fire, Fuels, and Air Quality Management. September 3, 2004.

[229] U.S. Fish and Wildlife Service. Formal Conference on the Robinson Mesa Prescribed Fire Project on the Clifton Ranger District of the Apache-Sitgreaves National Forests. October 5, 1999.

[230] Written communication with William Wall, Aquatic Ecologist/Fisheries Biologist, Alpine and Clifton Ranger Districts in Apache-Sitgreaves National Forest. Received 2/21/06.

[231] Personal communication with Albert Sillas, Fisheries Biologist, Prescott National Forest on 2/106; Written communication with Jerry Monzingo, Biologist, Gila National Forest. Received 1/31/06.

10.2 SUMMARY OF FUTURE FIRE MANAGEMENT IMPACTS

252. In spikedace and loach minnow proposed CHD areas, and in many areas across the U.S., the USDA and the Department of the Interior are jointly implementing what is known as the "National Fire Plan," which grew out of a report to the President called *Managing the Impacts of Wildfire on Communities and the Environment: A Report to the President in Response to the Wildfires of 2000.* The National Fire Plan calls for a substantial increase in the number of forested acres treated annually to reduce hazardous fuels. Under the plan, WUI areas are defined by each agency "where human life, property, and natural resources are in imminent danger from catastrophic wildfire."[232] WUI generally include areas where houses meet or intermingle with undeveloped wildland vegetation. This makes the WUI a focal area for human-environment conflicts such as wildland fires.[233]

253. This analysis relies on data developed by the University of Wisconsin that integrates U.S. Census and USGS National Land Cover Data to map WUI areas according to the Federal Register definition of WUI (Federal Register 66:751, 2001).[234] WUI areas are composed of both "interface" and "intermix" communities. In both communities, housing must meet or exceed a minimum density of one structure per 40 acres. Intermix communities are places where housing and vegetation intermingle. Intermix areas are characterized by continuous wildland vegetation and more than 50 percent vegetation. Interface communities are areas with housing in the "vicinity" of contiguous vegetation, that is, areas with less than 50 percent vegetation but within 1.5 miles of an area over 1,325 acres (500 ha) that is more than 75 percent vegetated. The California Fire Alliance defines "vicinity" as all areas within 1.5 miles of wildland vegetation, roughly the distance that firebrands can be carried from a wildland fire to the roof of a house. Including interface communities captures those homes that are at risk of being burned in a wildland fire, regardless of whether or not the homes sit within the forest area.[235] Based on an analysis of the WUI data, overlap of the proposed CHD with WUI areas is limited. Approximately 910 acres of WUI areas fall within the proposed CHD across five proposed CHD complexes and five stream reaches.[236] These 910 WUI acres comprise only 2.18 percent of the total acres proposed as critical habitat and only 0.01 percent and 0.04 percent of the

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[232] USFS 2001. Biological Opinion on the AUSFS Proposed Wildland/Urban Interface (WUI) Fuel treatments in New Mexico and Arizona and their effects on listed and proposed species in accordance with section 7 of the Endangered Species Act, Service, April 2001.

[233] "The Wildland-Urban Interface," University of Wisconsin, Department of Forest Ecology & Management, Spatial analysis for conservation and sustainability (SILVIS) Lab, Online at: http://silvis.forest.wisc.edu/projects/WUI_Main.asp, Accessed on: November 30, 2004.

[234] Ibid. The Service notes that the Forest Service has also developed a WUI layer for both Arizona and New Mexico; however, because this layer only includes Forest Service lands, this analysis uses the more inclusive layer developed by the University of Wisconsin.

[235] Ibid.

[236] In estimating the WUI areas that overlap with the proposed CHD, this analysis excluded the following non-WUI areas: wildland intermix, uninhabited with vegetation, uninhabited and no vegetation, wildland with no vegetation, low density with no vegetation, medium density with no vegetation, and high density with no vegetation.

areas identified as potential WUI areas in New Mexico and Arizona, respectively. The number of acres that overlap WUI areas is presented by complex in Exhibit 10-2.

EXHIBIT 10-2. WILDLAND URBAN INTERFACE AREAS IN PROPOSED CHD

COMPLEX	STREAM REACH	OVERLAP WITH WUI (ACRES)
1	Verde River	475
2	East Fork Black River	19
3	San Pedro River	169
4	San Francisco River	182
5	Upper Gila River	65
	Total	**910**

Source:
University of Wisconsin, Department of Forest Ecology & Management, Spatial analysis for conservation and sustainability (SILVIS) Lab, Online at: http://silvis.forest.wisc.edu/projects/WUI_Main.asp

254. As part of the National Fire Plan effort, Action Agencies published new regulations for implementing section 7 consultation requirements in December 2003. These regulations provide an alternative process that "eliminates the need to conduct informal consultation and eliminates the need to provide written concurrence" from the Service for those National Fire Plan actions that the Action Agency determines are "not likely to adversely affect (NLAA) any listed species or its designated critical habitat."

255. Perhaps the most costly effects on fire management activities would be borne by agencies if they attempt to protect spikedace and loach minnow populations from an ongoing wildfire. In the past, Federal and State agencies have made several attempts to evacuate other native fish populations when a fire was expected to destroy habitat on public lands.[237] However, as stated above, no previous evacuations of spikedace and loach minnow populations due to fire threat have been undertaken.[238] The cost of an evacuation will vary depending on the urgency of the evacuation (this can affect the number of staff required) and remoteness the area (this can affect the transport method used--trucks, mules, or helicopters), and is estimated to range from $2,000 to $5,000.[239] After a wildfire moves through an area, the affected native fish population must be reestablished. Depending on the severity of the fire, it can take several months to years for the habitat to

[237] Personal communication with Ron Maes, US Forest Service Region 3, July 18, 2005. Personal communication with Jerry Monzingo, Fisheries Biologist, Gila National Forest, US Forest Service, June 9, 2005.

[238] An evacuation was considered following the 3 Forks Fire in Apache-Sitgreaves National Forest, but was abandoned when only two fish were found. Per email from William Wall, Aquatic Ecologist/Fisheries Biologist, Alpine and Clifton Ranger Districts in Apache-Sitgreaves National Forest. Received 2/21/06.

[239] Evacuating a population is least expensive using a mule or a truck and most expensive using a helicopter.

be restored.[240] Holding native fish in captivity and reestablishment is assumed to cost approximately $40,000 per effort, but this cost could vary widely depending on the extent of damage that occurs to the habitat and the length of time that the fish must be held.[241] Therefore, the total costs of spikedace and loach minnow evacuation and reestablishment in the event of a wildfire are estimated to be approximately $42,000 to $45,000. However, due to the difficulty in predicting the locations of future catastrophic wildfires, this analysis does not assign evacuation and reestablishment costs to stream reaches within the proposed CHD.

256. Expected impacts on fire management activities include administrative costs related to section 7 consultation on fire management plans, as well as the potential cost of evacuation and reestablishment of spikedace and loach minnow populations in the event of a wildfire. In addition, the overlap of 910 acres of WUI area may pose some increased risk of fire to those and nearby areas.

[240] Written communication with William Wall, Aquatic Ecologist/Fisheries Biologist, Alpine and Clifton Ranger Districts in Apache-Sitgreaves National Forest. Received 2/21/06.

[241] This analysis assumes the costs holding a spikedace or loach minnow in captivity and reestablishing the population is similar to reestablishing a population ($40,000). Written communication from Ted Cordery, Endangered Species Coordinator, Arizona State Office, Bureau of Land Management, July 20, 2005.

REFERENCES

5 U.S.C. §§601 *et seq*

5 U.S.C. 605(b).

16 U.S.C. 1533.

16 U.S.C. §1533(b)(2).

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APPENDIX A | ADMINISTRATIVE COSTS

257. This appendix presents administrative costs of actions taken under section 7 of the Act associated with the geographic area proposed as critical habitat for the spikedace and loach minnow. First, this Appendix defines the types of administrative costs likely to be associated with the proposed habitat. Next, the Appendix presents estimates of the number of technical assistance efforts and consultations likely to result from the designation of critical habitat and/or the listing of the spikedace and loach minnow, as well as the per-unit costs of each of these activities. Based on this analysis, estimates of past and future administrative costs are derived.

A.1 CATEGORIES OF ADMINISTRATIVE COSTS

258. The following section provides an overview of the categories of administrative cost impacts that arise due to the implementation of section 7 in the geographic area proposed as critical habitat for the spikedace and loach minnow.

TECHNICAL ASSISTANCE

259. Frequently, the Service responds to requests for technical assistance from State agencies, local municipalities, and private landowners and developers who may have questions regarding whether specific activities may affect critical habitat. Technical assistance costs represent the estimated economic costs of informational conversations between these entities and the Service regarding the designation of critical habitat for the spikedace and loach minnow. Most likely, such conversations will occur between municipal or private property owners and the Service regarding lands designated as critical habitat or lands adjacent to critical habitat. The Service's technical assistance activities are voluntary and generally occur in instances where a Federal nexus does not exist.

SECTION 7 CONSULTATIONS

260. Section 7(a)(2) of the Act requires Federal agencies (Action agencies) to consult with the Service whenever activities that they undertake, authorize, permit, or fund may affect a listed species or designated critical habitat. There are two scenarios under which the designation of critical habitat can result in section 7 consultations with the Service beyond those required by the listing. These include:

- New consultations, which can occur when activities involving a Federal nexus are proposed in critical habitat not thought to be currently occupied by the species; and

- Re-initiations of consultations, which result when consultations that previously occurred under the listing are re-initiated due to new information or circumstances generated by the designation.

In some cases, consultations will involve the Service and another Federal agency only, such as the U.S. Forest Service. More often, they will also include a third party involved in projects on non-Federal lands with a Federal nexus, such as state agencies and private landowners.

261. During a consultation, the Service, the Action agency, and the landowner manager applying for Federal funding or permitting (if applicable) communicate in an effort to minimize potential adverse effects to the species and/or to the proposed critical habitat. Communication between these parties may occur via written letters, phone calls, in-person meetings, or any combination of these. The duration and complexity of these interactions depends on a number of variables, including the type of consultation, the species, the activity of concern, and the potential effects to the species and designated critical habitat associated with the activity that has been proposed, the Federal agency, and whether there is a private applicant involved.

262. Section 7 consultations with the Service may be either informal or formal. *Informal consultations* consist of discussion between the Service, the Action agency, and the applicant concerning an action that may affect a listed species or its designated critical habitat. The process is designed to identify and resolve potential concerns at an early stage in the planning process. By contrast, a *formal consultation* is required if the Action agency determines that its proposed action may or will adversely affect the listed species or designated critical habitat in ways that cannot be resolved through informal consultation. The formal consultation process results in the Service's determination in its Biological Opinion of whether the action is likely to jeopardize a species or adversely modify critical habitat, and recommendations to minimize those impacts. Regardless of the type of consultation or proposed project, section 7 consultations can require substantial administrative effort on the part of all participants.

A.2 ESTIMATED COSTS OF CONSULTATIONS AND TECHNICAL ASSISTANCE

263. Estimates of the cost of an individual consultation and technical assistance request were developed from a review and analysis of historical section 7 files from a number of Service field offices around the country conducted in 2002. These files addressed consultations conducted for both listings and critical habitat designations. Cost figures were based on an average level of effort of low, medium, or high complexity, multiplied by the appropriate labor rates for staff from the Service and other Federal agencies.

264. The administrative costs estimates presented in this section take into consideration the level of effect of the Service, the Action agency, and the applicant, as well as the varying complexity of the consultation or the technical assistance request. Costs associated with these consultations include the administrative costs associated with conducting the consultations, such as the costs of time spent in meetings, preparing letters, and the

development of a biological opinion. Exhibit A-1 provides a summary of the estimated administrative costs of consultations and technical assistance requests.

EXHIBIT A-1. ESTIMATED ADMINISTRATIVE COSTS OF CONSULTATION AND TECHNICAL ASSISTANCE EFFORTS (PER EFFORT)

CONSULTATION TYPE	SERVICE	ACTION AGENCY	THIRD PARTY	BIOLOGICAL ASSESSMENT
Technical Assistance	$260-$680	N/A	$600-$1,500	N/A
Informal Consultation	$1,000-$3,100	$1,300-$3,900	$1,200-$2,900	$0-$4,000
Formal Consultation	$3,100-$6,100	$3,900-$6,500	$2,900-$41,00	$4,000-$5,600

Source: IEc analysis based on data from the Federal Government Schedule Rates, Office of Personnel Management, 2002, a review of consultation records from several Service field offices across the country. Confirmed by local Action agencies.
Note: Low and high estimates primarily reflect variations in staff wages and time involvement by staff.

A.3 SUMMARY OF PAST ADMINSTRATIVE COSTS

265. Since the listing of the spikedace and loach minnow in 1986, there have been 91 formal section 7 consultations in the geographic area proposed as critical habitat for the spikedace and loach minnow.

266. As shown in Exhibit A-2, past administrative costs are estimated at $1.9 million to $4.9 million. Administrative costs resulting from past formal consultations are estimated to have been between $1.1 million and $1.7 million while informal consultations and technical assistance requests are estimated to have cost between $0.9 million and $3.1 million since the listing of the species.[242]

A.4 SUMMARY OF FUTURE ADMINISTRATIVE COSTS

267. Because the consultation record contains two previous designations of spikedace and loach minnow critical habitat (1994-1998 and 2000-2004), this analysis assumes that the rate of consultation will be roughly the same in the future as it was in the past. As shown in Exhibit A-5, future administrative costs are estimated at $1.0 to $2.6 million, assuming a seven percent discount rate over twenty years, or $181,000 to $460,000 annually (discounted at seven percent).

[242] To estimate the number of informal consultations, a ratio of informal consultations to formal consultations of 2.4 to 1 was used. This ratio was based on comparing the average number of informal consultations per year to the average number of formal consultations per year. To estimate the number of technical assistance requests, a ratio of technical assistance requests to formal consultations of 3 to 1 was used. This ratio was based on information provided by the Service for the Southwestern willow flycatcher EA.

A.5 CAVEATS

268. The number of consultations and technical assistance efforts to be undertaken in the future for activities within a given complex is highly uncertain. The frequency of such efforts will be related to the level of economic activity, the presence of HCPs or other regional plans that obviate the need for consultation, and the extent to which economic activity overlaps with critical habitat. To the extent that this analysis over or underestimates the number of these efforts in the future, estimated costs will be over or understated.

EXHIBIT A-2. PAST ADMINISTRATIVE COSTS BY RIVER SEGMENT AND BY ACTIVITY, 1986-2005, $2005

RIVER SEGMENT	TYPE OF CONSULT	DEVELOP-MENT	FIRE	GRAZING	SPECIES MGMT & RECREATION	TRANSPORTA-TION	WATER	OTHER	TOTAL NUMBER	TOTAL COSTS (LOW)	TOTAL COSTS (HIGH)
Verde River	Formals	1	0	2	0	4	4	1	12	$172,000	$276,000
	Informals	2	0	5	0	10	10	2	29	$104,000	$412,000
	Technical Assistance	3	0	6	0	12	12	3	36	$32,000	$81,000
								Subtotal	**77**	**$308,000**	**$769,000**
E. Fork Black River	Formals	0	0	2	1	0	0	0	3	$43,000	$69,000
	Informals	0	0	5	2	0	0	0	7	$26,000	$103,000
	Technical Assistance	0	0	6	3	0	0	0	9	$8,000	$20,000
								Subtotal	**19**	**$77,000**	**$192,000**
N. Fork E. Fork Black River	Formals	0	0	2	1	0	0	0	3	$43,000	$69,000
	Informals	0	0	5	2	0	0	0	7	$26,000	$103,000
	Technical Assistance	0	0	6	3	0	0	0	9	$8,000	$20,000
								Subtotal	**19**	**$77,000**	**$192,000**
Aravaipa Creek	Formals	0	0	0	1	1	1	0	3	$43,000	$69,000
	Informals	0	0	0	2	2	2	0	7	$26,000	$103,000
	Technical Assistance	0	0	0	3	3	3	0	9	$8,000	$20,000
								Subtotal	**19**	**$77,000**	**$192,000**
Gila River	Formals	0	0	1	0	0	2	0	3	$43,000	$69,000
	Informals	0	0	2	0	0	5	0	7	$26,000	$103,000
	Technical Assistance	0	0	3	0	0	6	0	9	$8,000	$20,000
								Subtotal	**19**	**$77,000**	**$192,000**

RIVER SEGMENT	TYPE OF CONSULT	DEVELOP-MENT	FIRE	GRAZING	SPECIES MGMT & RECREATION	TRANSPORTA-TION	WATER	OTHER	TOTAL NUMBER	TOTAL COSTS (LOW)	TOTAL COSTS (HIGH)
Blue River	Formals	0	0	9	1	2	4	1	17	$243,000	$390,000
	Informals	0	0	22	2	5	10	2	41	$147,000	$584,000
	Technical Assistance	0	0	27	3	6	12	3	51	$45,000	$114,000
								Subtotal	**109**	**$436,000**	**$1,089,000**
Campbell Blue Creek	Formals	0	0	0	0	0	0	1	1	$14,000	$23,000
	Informals	0	0	0	0	0	0	2	2	$9,000	$34,000
	Technical Assistance	0	0	0	0	0	0	3	3	$3,000	$7,000
								Subtotal	**6**	**$26,000**	**$64,000**
Eagle Creek	Formals	0	1	5	0	0	2	0	8	$115,000	$184,000
	Informals	0	2	12	0	0	5	0	19	$69,000	$275,000
	Technical Assistance	0	3	15	0	0	6	0	24	$21,000	$54,000
								Subtotal	**51**	**$205,000**	**$512,000**
San Francisco River	Formals	0	0	10	1	1	0	1	13	$186,000	$299,000
	Informals	0	0	24	2	2	0	2	31	$112,000	$447,000
	Technical Assistance	0	0	30	3	3	0	3	39	$35,000	$88,000
								Subtotal	**83**	**$333,000**	**$833,000**
Multiple	Formals	0	1	1	3	0	4	4	13	$186,000	$299,000
	Informals	0	2	2	7	0	10	10	31	$112,000	$447,000
	Technical Assistance	0	3	3	9	0	12	12	39	$35,000	$88,000
								Subtotal	**83**	**$333,000**	**$833,000**

RIVER SEGMENT	TYPE OF CONSULT	DEVELOP-MENT	FIRE	GRAZING	SPECIES MGMT & RECREATION	TRANSPORTA-TION	WATER	OTHER	TOTAL NUMBER	TOTAL COSTS (LOW)	TOTAL COSTS (HIGH)
Total	Formal	1	2	32	8	8	17	8	76	$1,087,775	$1,745,136
	Informal	2	5	77	19	19	41	19	182	$657,360	$2,610,660
	Technical Assistance	3	6	96	24	24	51	24	228	$201,904	$511,802
Total Costs Low		$25,619	$51,238	$819,806	$204,951	$204,951	$435,522	$204,951	$1,947,039	$1,947,039	-
Total Costs High		$64,047	$128,095	$2,049,515	$512,379	$512,379	$1,088,805	$512,379	$4,867,598	-	$4,867,598

NOTES: For technical assistance, a ratio of technical assistance requests to formal consultations of 3 to 1 is assumed. For informal consultations, a ratio of informal consultations to formal consultations of 2.4 to 1 is assumed.

A-3. FUTURE ADMINISTRATIVE COSTS BY REACH AND BY ACTIVITY (2006-2025),$2005

RIVER SEGMENT	TYPE OF CONSULT	DEVELOP-MENT	FIRE	GRAZING	SPECIES MGMT & RECREATION	TRANSPORTA-TION	WATER	OTHER	TOTAL NUMBER	TOTAL COSTS (LOW)	TOTAL COSTS (HIGH)
Verde River	Formals	1	0	2	0	4	4	1	12	$172,000	$276,000
	Informals	2	0	5	0	10	10	2	29	$104,000	$412,000
	Technical Assistance	3	0	6	0	12	12	3	36	$32,000	$81,000
								Subtotal	**77**	**$308,000**	**$769,000**
E. Fork Black River	Formals	0	0	2	1	0	0	0	3	$43,000	$69,000
	Informals	0	0	5	2	0	0	0	7	$26,000	$103,000
	Technical Assistance	0	0	6	3	0	0	0	9	$8,000	$20,000
								Subtotal	**19**	**$77,000**	**$192,000**
N. Fork E. Fork Black River	Formals	0	0	2	1	0	0	0	3	$43,000	$69,000
	Informals	0	0	5	2	0	0	0	7	$26,000	$103,000
	Technical Assistance	0	0	6	3	0	0	0	9	$8,000	$20,000
								Subtotal	**19**	**$77,000**	**$192,000**
Aravaipa Creek	Formals	0	0	0	1	1	1	0	3	$43,000	$69,000
	Informals	0	0	0	2	2	2	0	7	$26,000	$103,000
	Technical Assistance	0	0	0	3	3	3	0	9	$8,000	$20,000
								Subtotal	**19**	**$77,000**	**$192,000**
Gila River	Formals	0	0	1	0	0	2	0	3	$43,000	$69,000
	Informals	0	0	2	0	0	5	0	7	$26,000	$103,000
	Technical Assistance	0	0	3	0	0	6	0	9	$8,000	$20,000
								Subtotal	**19**	**$77,000**	**$192,000**

RIVER SEGMENT	TYPE OF CONSULT	DEVELOP-MENT	FIRE	GRAZING	SPECIES MGMT & RECREATION	TRANSPORTA-TION	WATER	OTHER	TOTAL NUMBER	TOTAL COSTS (LOW)	TOTAL COSTS (HIGH)
Blue River	Formals	0	0	9	1	2	4	1	17	$243,000	$390,000
	Informals	0	0	22	2	5	10	2	41	$147,000	$584,000
	Technical Assistance	0	0	27	3	6	12	3	51	$45,000	$114,000
								Subtotal	**109**	**$436,000**	**$1,089,000**
Campbell Blue Creek	Formals	0	0	0	0	0	0	1	1	$14,000	$23,000
	Informals	0	0	0	0	0	0	2	2	$9,000	$34,000
	Technical Assistance	0	0	0	0	0	0	3	3	$3,000	$7,000
								Subtotal	**6**	**$26,000**	**$64,000**
Eagle Creek	Formals	0	1	5	0	0	2	0	8	$115,000	$184,000
	Informals	0	2	12	0	0	5	0	19	$69,000	$275,000
	Technical Assistance	0	3	15	0	0	6	0	24	$21,000	$54,000
								Subtotal	**51**	**$205,000**	**$512,000**
San Francisco River	Formals	0	0	10	1	1	0	1	13	$186,000	$299,000
	Informals	0	0	24	2	2	0	2	31	$112,000	$447,000
	Technical Assistance	0	0	30	3	3	0	3	39	$35,000	$88,000
								Subtotal	**83**	**$333,000**	**$833,000**
Multiple	Formals	0	1	1	3	0	4	4	13	$186,000	$299,000
	Informals	0	2	2	7	0	10	10	31	$112,000	$447,000
	Technical Assistance	0	3	3	9	0	12	12	39	$35,000	$88,000
								Subtotal	**83**	**$333,000**	**$833,000**

RIVER SEGMENT	TYPE OF CONSULT	DEVELOP-MENT	FIRE	GRAZING	SPECIES MGMT & RECREATION	TRANSPORTA-TION	WATER	OTHER	TOTAL NUMBER	TOTAL COSTS (LOW)	TOTAL COSTS (HIGH)
Total	Formal	1	2	32	8	8	17	8	76	$1,087,775	$1,745,136
	Informal	2	5	77	19	19	41	19	182	$657,360	$2,610,660
	Technical Assistance	3	6	96	24	24	51	24	228	$201,904	$511,802
Total Costs Low		$25,619	$51,238	$819,806	$204,951	$204,951	$435,522	$204,951	$1,947,039	$1,947,039	-
Total Costs High		$64,047	$128,095	$2,049,515	$512,379	$512,379	$1,088,805	$512,379	$4,867,598	-	$4,867,598

EXHIBIT A-4. TOTAL PAST ADMINSTRATIVE COSTS, 1986-2005, $2005

COMPLEX	RIVER SEGMENT	TOTAL ADMINISTRATIVE COSTS	
		LOW	HIGH
Complex 1	Verde River	$307,427	$768,568
	Boneyard Creek	$0	$0
	East Fork Black River	$76,857	$192,142
Complex 2	North East Fork Black River	$76,857	$192,142
	Aravaipa Creek	$76,857	$192,142
	Deer Creek	$0	$0
	Turkey Creek	$0	$0
	Gila River	$76,857	$192,142
Complex 3	San Pedro River	$0	$0
	Eagle Creek	$204,951	$512,379
	San Francisco River	$333,046	$832,615
	Tularosa River	$0	$0
	Frieborn Creek	$0	$0
	Negrito Creek	$0	$0
	Whitewater Creek	$0	$0
	Blue River	$435,522	$1,088,805
	Campbell Blue Creek	$25,619	$64,047
	Little Blue Creek	$0	$0
	Dry Blue Creek	$0	$0
Complex 4	Pace Creek	$0	$0
	East Fork Gila River	$0	$0
	Upper Gila River	$0	$0
	Middle Fork Gila River	$0	$0
Complex 5	West Fork Gila River	$0	$0
	Multiple	$333,046	$832,615
	Total	**$1,947,039**	**$4,867,598**

Note: Totals may not sum due to rounding

EXHIBIT A-5. TOTAL FUTURE ADMINISTRATIVE COSTS, 2006-2025

		UNDISCOUNTED DOLLARS		PRESENT VALUE 3%		PRESENT VALUE 7%		ANNUALIZED 3%		ANNUALIZED 7%	
COMPLEX	RIVER SEGMENT	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH
Complex 1	Verde River	$307,000	$769,000	$228,000	$572,000	$163,000	$407,000	$21,000	$52,000	$29,000	$73,000
Complex 2	Boneyard Creek	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	East Fork Black River	$77,000	$192,000	$57,000	$143,000	$41,000	$102,000	$5,000	$13,000	$7,000	$18,000
	North East Fork Black River	$77,000	$192,000	$57,000	$143,000	$41,000	$102,000	$5,000	$13,000	$7,000	$18,000
Complex 3	Aravaipa Creek	$77,000	$192,000	$57,000	$143,000	$41,000	$102,000	$5,000	$13,000	$7,000	$18,000
	Deer Creek	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Turkey Creek	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Gila River	$77,000	$192,000	$57,000	$143,000	$41,000	$102,000	$5,000	$13,000	$7,000	$18,000
	San Pedro River	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Complex 4	Eagle Creek	$205,000	$512,000	$152,000	$381,000	$109,000	$271,000	$14,000	$34,000	$19,000	$48,000
	San Francisco River	$333,000	$833,000	$248,000	$620,000	$176,000	$441,000	$22,000	$56,000	$31,000	$79,000
	Tularosa River	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Frieborn Creek	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Negrito Creek	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Whitewater Creek	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Blue River	$436,000	$1,089,000	$324,000	$810,000	$231,000	$577,000	$29,000	$73,000	$41,000	$103,000
	Campbell Blue Creek	$26,000	$64,000	$19,000	$48,000	$14,000	$34,000	$2,000	$4,000	$2,000	$6,000
	Little Blue Creek	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Dry Blue Creek	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Pace Creek	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Complex 5	East Fork Gila River	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Upper Gila River	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Middle Fork Gila River	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	West Fork Gila River	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Multiple	$333,000	$833,000	$248,000	$620,000	$176,000	$441,000	$22,000	$56,000	$31,000	$79,000
	Total	**$1,947,000**	**$4,868,000**	**$1,448,000**	**$3,621,000**	**$1,031,000**	**$2,579,000**	**$130,000**	**$327,000**	**$277,000**	**$689,000**

Note: Totals may not sum due to rounding.

APPENDIX B | SMALL BUSINESS AND ENERGY IMPACTS ANALYSES

269. This Appendix considers the extent to which the analytic results presented in the previous Sections reflect potential future impacts to small businesses and the energy industry. The small business analysis presented in this appendix is conducted pursuant to the RFA as amended by the SBREFA in 1996. Information was gathered from the Small Business Administration, U.S. Census Bureau, and the National Agricultural Statistical Service. The energy analysis in Section B.2 is conducted pursuant to Executive Order No. 13211.

B.1 SBREFA ANALYSIS

270. In accordance with SBREFA, when a Federal agency publishes a notice of rulemaking for any proposed or final rule, it must make available for public comments a regulatory flexibility analysis that describes the effect of the rule on small entities (i.e., small businesses, small organizations, and small government jurisdictions).[243] No regulatory flexibility analysis is required, however, if the head of an agency certifies that the rule will not have a significant economic impact on a substantial number of small entities.[244] SBREFA amended the RFA to require Federal agencies to provide a statement of the factual basis for certifying that a rule will not have significant economic impact on a substantial number of small entities.

271. To assist in this process, the following represents a screening level analysis of the possible effects of the designation of conservation activities for the spikedace and loach minnow on small entities. This analysis presents activities with potential impacts associated with the proposed rulemaking, describes the industries that may experience small business impacts due to spikedace and loach minnow conservation activities, and then details and quantifies the specific impacts to potentially affected small businesses.

B.1.1 IDENTIFICATION OF ACTIVITIES THAT MAY INVOLVE SMALL ENTITIES

272. This analysis estimates prospective economic impacts due to implementation of spikedace and loach minnow conservation activities in nine categories:

1. Water management and use;
2. Livestock grazing activities;

[243] 5 U.S.C. 601 et seq.

[244] 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." 5 U.S.C. 605(b).

3. Mining operations;
4. Spikedace and loach minnow specific management activities;
5. Recreation
6. Residential and related development;
7. Tribes;
8. Transportation; and
9. Fire management.

In four of these nine categories, impacts of spikedace and loach minnow conservation are not anticipated to impact small businesses for the following reasons:

- *Mining:* Section 5 of this analysis discusses the potential impacts of spikedace and loach minnow conservation activities on mining that may be affected by the proposed CHD. As discussed in Section 5, ASARCO and PDC are concerned that impacts to five large mining operations could occur, particularly if water use by these facilities is affected. Neither ASARCO nor PDC are small entities.
- *Spikedace and loach minnow specific management:* Section 6 of this analysis presents the potential costs of spikedace and loach minnow specific management activities. As USBR, BLM, USFS, the Service, and State game and fish departments are expected to bear these costs, no impacts on small entities are anticipated for this category.
- *Tribes:* Section 8 of this analysis details the potential impacts of spikedace and loach minnow conservation activities on the San Carlos Apache Tribe, White Mountain Apache Tribe, and the Yavapai-Apache Nation.
- *Transportation:* Section 9 of this analysis presents the potential costs to transportation activities. These costs are expected to be borne by the USFS and the ADOT. Therefore, this category of impacts is not expected to affect small entities.
- *Fire management activities:* Section 10 of this analysis discusses the potential impacts of spikedace and loach minnow conservation activities on fire management activities within the proposed CHD. Any increased costs of fire management are expected to be borne by County, State, and Federal agencies, suggesting that impacts on small entities related to fire management activities are unlikely.

273. The remainder of this section addresses the potential impacts to each of the activities identified above that may involve small entities. For each activity, the number of small entities affected and potential economic impact on those small entities is estimated.

B.1.2 ANALYSIS OF IMPACTS TO SMALL BUSINESSES RELATED TO WATER MANAGEMENT AND USE: AGRICULTURAL CROP PRODUCTION

274. Spikedace and loach minnow conservation activities have not impacted crop production since the listing of the species in 1986. However, because agricultural water use comprises 98 percent of surface water use and 81 percent of groundwater use in counties that contain CHD, it appears most likely that any additional water supplies needed for the species would come from current agricultural use. The analysis considers a scenario in which farmers give up agricultural water use in proposed CHD areas in an effort to provide adequate water supply for the species, leading to reductions in crop production.

275. If farmers give up agricultural water use in proposed CHD areas and retire agricultural land from production, a loss in land value associated with transitioning irrigated cropland to unirrigated lands (pasturelands) will likely result. Losses in land value associated with retiring cropland from production range from $3,175 to $6,190 per acre, depending on the area in which critical habitat is located. A total of 6,310 acres of cropland are in the vicinity of proposed CHD (in the same valley) and are likely to rely on surface water from CHD; 810 of these acres are located within proposed spikedace and loach minnow habitat.

276. The analysis uses USDA/NASS 2002 Census of Agriculture data to estimate the number of small farms in counties that contain proposed spikedace and loach minnow CHD. Exhibit B-2 summarizes the number of farms in each State according to value of sales. According to SBA size standards, on a value of sales basis, nearly all farms in the affected counties are categorized as small.[245]

EXHIBIT B-2. FARM OPERATIONS CLASSIFIED BY VALUE OF ANNUAL SALES (2002)

COUNTY	TOTAL NO. OPERATIONS	LESS THAN $2,500	$2,500-$9,999	$10,000-$49,999	$50,000-$99,999	$100,000 OR MORE
Pinal, AZ	687	265	101	58	29	234
Yavapai, AZ	575	314	114	86	19	42
Catron, NM	206	82	39	48	15	22
Grant, NM	272	114	58	63	20	17
Hidalgo, NM	144	39	22	33	26	24
Total	**1,884**	**814**	**334**	**288**	**109**	**339**
Percent	**100%**	**43%**	**18%**	**15%**	**6%**	**18%**

Notes: The Small Business Administration defines most farming activities that earn less than $750,000 in annual revenues as small entities.
Sources: NASS, 2002 Census of Agriculture, Table 1. County Summary Highlights, Arizona and New Mexico.

[245] The Small Business Administration defines most farming activities as small entities that earn less than $750,000 in annual revenues. The NASS Census data does not allow a specific determination of the number of small farms, as all operations greater than $100,000 are grouped together. However, 82 percent of farms can be confirmed as small with available data.

277. An average farm size in affected counties ranges from 1,300 acres to 7,800 acres. Assuming affected farms are average-sized for their counties, approximately one to five farms could experience reductions in crop production as a result of spikedace and loach minnow critical habitat designation. Alternatively, the median farm size in affected counties ranges from 41 to 1,300 acres. Assuming affected farms are median-sized for their counties, approximately four to 119 farms could experience reductions in crop production as a result of spikedace and loach minnow critical habitat designation. Under the assumption that all farms are small (1,884 farms across five counties), the estimate of future impacts (one to 199 farms) represents between less than one percent to 6.5 percent of total small farm operations in counties that contain proposed spikedace and loach minnow habitat. This information is summarized in Exhibit B-3.

EXHIBIT B-3. PERCENT OF FARM OPERATIONS LIKELY TO BE AFFECTED BY SPIKEDACE AND LOACH MINNOW CHD

COUNTY	TOTAL NO. OPERATIONS IN COUNTY	AVERAGE FARM SIZE (ACRES)	MEDIAN FARM SIZE (ACRES)	IRRIGATED ACRES IN CHD	IRRIGATED ACRES IN VICINITY OF CHD	ESTIMATED NUMBER OF FARMS AFFECTED	PERCENT OF TOTAL FARMS AFFECTED
Pinal, AZ	687	1,691	289	134	1,223	0.1 to 4	0% to 0.6%
Yavapai, AZ	575	1,253	41	504	4,895	0.4 to 119	0.1% to 20.8%
Catron, NM	206	7,985	1,200	6	6	0	0%
Grant, NM	272	4,478	730	48	48	0	0%
Hidalgo, NM	144	7,830	1,340	137	137	0	0%
CHD Region	**1,884**	**4,647**	**720**	**830**	**6,310**	**1 to 123**	**0.1% to 6.5%**

Source: NASS, 2002 Census of Agriculture, Table 1. County Summary Highlights, Arizona and New Mexico.

278. Because of the uncertainty involved in estimating that reduced agricultural production will occur, this scenario is included in the high estimate of impacts to water users.

B.1.3 ANALYSIS OF IMPACTS TO SMALL BUSINESSES RELATED TO LIVESTOCK GRAZING

279. Ranching operations that hold Federal grazing allotment permits are anticipated to experience economic impacts as they implement species conservation requirements for grazing activities. Assuming that each Federal grazing allotment falling within critical habitat is run by a unique ranching operation, approximately 76 ranching operations may be impacted annually, representing 4.7 percent of ranches in the affected counties, or one percent of ranches in New Mexico and Arizona. Annual costs to each of these 76 ranching operations may be between $390 and $9,200 per ranch. Average revenues of a

ranch in the proposed CHD region are $166,700.[246] Thus, these potential losses represent between 0.2 and 5.5 percent of each ranch's estimated average revenues. Exhibit B-4 presents the average revenues of ranches by county.

EXHIBIT B-4. RANCH REVENUES IN COUNTIES AFFECTED BY PROPOSED CHD FOR SPIKEDACE AND LOACH MINNOW (2002)

	COUNTY	TOTAL CALF SALES ($2005)	NUMBER OF RANCHES	AVERAGE REVENUES PER RANCH
Arizona	Apache	$7,758,000	227	$34,200
	Graham	$3,964,000	123	$32,200
	Greenlee	$2,347,000[1]	123	$19,100
	Navajo	$7,511,000[1]	207	$36,300
	Pinal	$207,589,000	226	$918,500
	Yavapai	$17,505,000[1]	263	$66,600
New Mexico	Catron	$8,248,000	154	$53,600
	Grant	$7,660,000	192	$39,900
	Hidalgo	$5,363,000	92	$58,300
Region (Counties containing CHD)		**$267,945,000**	**1,607**	**$166,700**

[1] 1997 figure updated to $2005. All other statistics are 2002 figures updated to $2005.
Note: Figures may not sum due to rounding
Source: National Agriculture Statistical Service. 2002 Census of Agriculture Volume 1, Chapter 2: Arizona County Level Data, Table 1 County Summary Highlights, Table 11 Cattle and Calves-Inventory and Sales 2002 and 1997, accessed at http://www.nass.usda.gov/census/census02/volume1/az/index2.htm on Feb. 25, 2006; National Agriculture Statistical Service. 2002 Census of Agriculture Volume 1, Chapter 2: New Mexico County Level Data, Table 1 County Summary Highlights, Table 11 Cattle and Calves-Inventory and Sales 2002 and 1997, accessed at http://www.nass.usda.gov/census/census02/volume1/nm/index2.htm on Feb. 25, 2006.

280. Approximately 94 percent of beef cattle ranching and farming operations (NAICS 112111) in counties containing spikedace and loach minnow CHD are small businesses.[247] While specific revenue data for affected small beef cattle ranches is not readily available, a proxy for this can be developed by eliminating the revenue outlier (Pinal County) from the county average revenue estimates. This results in an estimate of average revenues for small ranches of $42,500.[248] Using this estimate of revenues,

[246] This number is based on census data from 2002. Actual revenues can vary in any given year based on the prevailing natural conditions such as drought, etc. According to some commenters, the current drought has negatively impacted revenues for many ranches located within CHD. P.C. Jim and Clarice Holder, July 6, 2006.

[247] Dialog search of File 516, Dun and Bradstreet, "Duns Market Identifiers," NAICS Code 11211 on March 10, 2006.

[248] AS stated above, this number is based on census data from 2002. Actual revenues can vary in any given year based on the prevailing natural conditions such as drought, etc. According to some commenters, the current drought has negatively impacted revenues for many ranches located within CHD. P.C. Jim and Clarice Holder, July 6, 2006.

approximately 72 small ranching operations may experience a reduction in revenues of between 0.9 and 22 percent of revenues annually. These ranches represent would 4.7 percent of ranches in affected counties, or one percent of ranches in New Mexico and Arizona. The extent to which these impacts are significant to any of these ranching operations will depend on the individual financial conditions of each ranch.

B.1.4 ANALYSIS OF IMPACTS TO SMALL BUSINESSES RELATED TO RESIDENTIAL AND COMMERCIAL DEVELOPMENT

281. Section 7 of the analysis considers the impacts of spikedace and loach minnow conservation activities on real estate development activities. The analysis finds that impacts are likely to occur in the Verde River segment, particularly on the Lower Verde portion of the Verde River segment, which contains a large amount of private land, a relatively large human population, and high projected population growth potential in the next 20 years.

282. Impacts to development activities are estimated to include fencing costs, scientific studies, surveying and monitoring requirements, and possibly off-setting mitigation (habitat set-aside). Costs are estimated to range from $3.1 million to $4.8 million per large development, or $3,900 to $5,900 per housing unit ($190 to $300 annually, if costs are distributed evenly over 20 years). Total impacts to development activities are estimated at $3.4 to $5.2 million over 20 years, or $319,000 to $419,000 annually (assuming a discount rate of seven percent).

283. Actual conservation requirements undertaken by an individual landowner will depend on how much of a parcel crosses proposed CHD and the extent to which development activities can be planned around sensitive areas. In addition, individual single-family home development has not historically been subject to consultation or habitat conservation plan requirements in Arizona.

284. To understand the potential impacts on small entities, this analysis makes the simplifying assumption that the private owners of developable lands in proposed CHD impacted by future spikedace and loach minnow conservation efforts will be developers. This analysis further assumes that project modification costs associated with spikedace and loach minnow conservation efforts will be borne by these developers.[249] This assumption is likely to overestimate the number of affected small development firms and associated costs, because the impacted landowners may in fact be individuals or families that are not registered businesses (e.g., they may be holding the land as an investment).[250]

285. To estimate the number of developers potentially impacted and the magnitude of that impact by spikedace and loach minnow conservation efforts, the analysis first estimates the number of residential housing units that are likely to be constructed within proposed

[249] Before purchasing a parcel the developer will consider the regulatory restrictions associated with that parcel. Therefore, any costs associated with conservation efforts for the CSI will be reflected in the price paid for the parcel. Thus, the costs of CSI conservation activities are ultimately borne by the current landowner in the form of reduced land values.

[250] No North American Industry Classification System (NAICS) code exists for landowners, and SBA does not provide a definition of small landowner.

critical habitat at maximum buildout given current zoning.[251] Second, the analysis estimates the number of developers required to build the potential residential housing units. Third, the analysis determines how many of those developers may be small. Lastly, the analysis determines the impact that spikedace and loach minnow conservation efforts may have on the revenues of small developers. These steps are detailed below.

- **Estimate the number of residential housing units constructed within proposed critical habitat.** Approximately 1,646 residential housing units are likely to be constructed within proposed critical habitat at maximum buildout given current zoning. If these are constructed over 20 years, this would be 82 units annually.
- **Estimate the number of developers required to construct the potential residential housing units.** On average a developer in this region constructs 43 residential housing units annually, therefore, 2 developers would be required to construct 82 housing units each year.[252]
- **Estimate number of small developers potentially impacted.** Approximately 97 percent of developers in the region are considered small, thus 2 small developers could be impacted each year.[253]
- **Estimate the impact of spikedace and loach minnow conservation efforts on revenues of small developers.** For those projects likely to be undertaken by a small entity, spikedace and loach minnow conservation costs are estimated to be approximately $3,900 to $5,900 per residential housing unit (total costs divided by the number of affected units), or $167,000 to $253,000 per typical developer. Assuming the annual revenues of an average small developer are $18.9 million,[254] the average annualized cost per project is roughly 1.0 to 1.6 percent of the typical annual sales.

In summary, this analysis estimate that 2 small developers may experience a reduction in revenues of 1.0 to 1.6 percent annually.

B.1.5 RECREATION

286. Areas currently stocked with non-native sportfish include the Camp Verde area of the Verde River in Complex 1 and East Fork Gila River in Complex 5. The future impact of proposed CHD on the stocking regimes in these reaches is unknown, as is the reduction in

[251] For the purposes of this analysis developers are considered to be in the following industry sectors: New Single-Family Housing Construction (except Operative Builders) (NAICS 236115); New Housing Operative Builders (NAICS 236117); Land Subdivision (NAICS 237210); and New Multifamily Housing Construction (except Operative Builders) (NAICS 236116).

[252] The weighted average for a developer in this region is $18.9 million. The average revenues for New Single-Family Housing Construction (except Operative Builders) is $16.2 million; New Housing Operative Builders is $24.0 million; Land Subdivision is $15.6 million; and New Multifamily Housing Construction (except Operative Builders) is $28.6 million. Source: Robert Morris Associates. 2005. Annual Statement Studies, Financial Ratio Benchmarks, 2005-2006.

[253] The average developer in this region is small. The Small Business Administration defines developers in the New Single-Family Housing Construction (except operative builders), New Multi-Family Housing Construction (except operative builders), and New Housing Operative Builders as small entities as those who earn less than $31 million in annual revenues. Developers in the Land Subdivision sector are defined as small if revenues are less than $6.5 million.

[254] Robert Morris Associates. 2005. Annual Statement Studies, Financial Ratio Benchmarks, 2005-2006.

fishing activity that would occur if stocking is curtailed. Further, it is unknown whether non-native fish stocking may be replaced with catchable native fish stocking (e.g. Apache trout). Thus, this analysis estimates the value of angler days at risk if sportfish stocking were discontinued on these reaches as part of the high end estimates. Angling trips are valued at approximately $8.6 million over 20 years (or $816,000 annually), assuming a discount rate of seven percent. It should be noted that because State fish managers typically identify alternative sites for stocked fish when areas are closed to stocking, these angler days are likely to be redistributed to other areas rather than lost altogether. Thus, the high-end estimate does not consider the possibility that rather than not fishing at all, recreators will visit alternative, less desirable fishing sites. Existing models of angler behavior in these areas were not available to refine this estimate.

287. The two stream reaches where impacts on recreation are anticipated are located in Yavapai County, Arizona and Catron County, New Mexico. If, as in the low-end estimate of impacts, angler trips are not lost, but instead are redistributed to other streams, then regional impacts on small businesses are likely to be minimal. If, as in the high-end estimate of impacts, angler trips to the two stream reaches that currently stock non-native fish are not undertaken, localized impacts on anglers and, in turn, small businesses that rely on fishing activities could occur.[255] These impacts would be spread across a variety of industries including food and beverage stores, food service and drinking places, accommodations, transportation, and sporting goods. These industries generate approximately $829 million in total annual sales for these two counties.[256] Based on the 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation for Arizona and New Mexico, average expenditures per fishing trip are approximately $37 ($2005), with the bulk of these expenditures occurring in the food service and gasoline industries. By multiplying this per-trip estimate by the number of fishing trips potentially lost due to spikedace and loach minnow conservation activities (0 to 13,260 days per year, assuming one day per trip), expenditures by these anglers are estimated to be up to $485,000 annually. The high-end estimate of annual loss of in trip expenditures could therefore represent a loss of approximately 0.06 percent of annual revenues for affected businesses.

B.2 POTENTIAL IMPACTS TO THE ENERGY INDUSTRY

288. Pursuant to Executive Order No. 13211, "Actions Concerning Regulations that Significantly Affect Energy Supply, Distribution, or Use," issued May 18, 2001, Federal agencies must prepare and submit a "Statement of Energy Effects" for all "significant energy actions." The purpose of this requirement is to ensure that all Federal agencies "appropriately weigh and consider the effects of the Federal Government's regulations on

[255] For example, one commenter suggests that past fishing closures on Eagle Creek and the Blue River have impacted local small businesses in Greenlee County. See Public Comments of D. Ely, July 6, 2006.

[256] US Census Bureau, American Factfinder, Table 4. Statistics by Economic Sector, Sub-Sector, Industry Group, NAICS Industry and US Industry 2002 for Yavapai County and Catron County. Accessed at http://factfinder.census.gov/servlet/GQRGeoSearchByListServlet?ds_name=EC0200A1&_lang=en&_ts=164115559643&ib_type=undefined on Apr. 26, 2006.

the supply, distribution, and use of energy."[257] The OMB's guidance for implementing this Executive Order outlines nine outcomes that may constitute "a significant adverse effect" as compared to a scenario without the regulatory action under consideration:

- Reductions in crude oil supply in excess of 10,000 barrels per day (bbls);
- Reductions in fuel production in excess of 4,000 barrels per day;
- Reductions in coal production in excess of 5 million tons per year;
- Reductions in natural gas production in excess of 25 million Mcf per year;
- Reductions in electricity production in excess of 1 billion kilowatts-hours per year or in excess of 500 megawatts of installed capacity;
- Increases in energy use required by the regulatory action that exceed the thresholds above;
- Increases in the cost of energy production in excess of one percent;
- Increases in the cost of energy distribution in excess of one percent; or
- Other similarly adverse outcomes.[258]

As none of these criteria is relevant to this analysis, energy-related impacts associated with spikedace and loach minnow conservation activities within the proposed CHD are not expected.

[257] Memorandum For Heads of Executive Department Agencies, and Independent Regulatory Agencies, Guidance For Implementing E.O. 13211, M-01-27, Office of Management and Budget, July 13, 2001, http://www.whitehouse.gov/omb/memoranda/m01-27.html.

[258] Ibid.

APPENDIX C:

DETAILED COST ESTIMATES OF GRAZING IMPACTS PRESENTED BY ALLOTMENT

EXHIBIT C-1. PAST COSTS BY ALLOTMENT

COMPLEX	RIVER SEGMENT	ALLOTMENT NAME	CHD ACRES IN ALLOTMENT	PERCENT OF ALLOTMENT IN CHD	AUMS LOST[1]	VALUE OF LOST GRAZING[2]	LENGTH CHD (MI)	COSTS OF FENCE CONSTRUCTION (UNDISCOUNTED)		TOTAL PAST COSTS (UNDISCOUNTED)	
								LOW	HIGH	LOW	HIGH
1	Verde River	Fossil Creek	111	0.3%	11.1	$899	1.64	$2,457	$24,570	$3,356	$25,469
		Hackberry/ Pivot Rock	285	0.4%	10.4	$844	4.91	$7,366	$73,664	$8,210	$74,508
		Ikes Backbone	86	2.8%	0.0	$0	0.17	$252	$2,517	$252	$2,517
		Thirteen-Mile Rock	13	0.0%	2.0	$163	0.00	$0	$0	$163	$163
		Antelope Hills	842	5.9%	60.3	$4,882	13.12	$19,676	$196,756	$24,557	$201,638
		Brown Springs	659	4.1%	70.8	$5,736	9.64	$14,462	$144,618	$20,198	$150,354
		China Dam	237	1.5%	7.4	$601	3.05	$4,571	$45,713	$5,173	$46,315
		Horseshoe	227	1.6%	13.5	$1,093	3.41	$5,108	$51,083	$6,202	$52,177
		Jerome	15	0.0%	0.5	$39	0.00	$0	$0	$39	$39
		Muldoon	241	1.0%	0.9	$74	3.69	$5,537	$55,371	$5,611	$55,445
		Perkinsville	187	0.4%	9.4	$759	2.62	$3,923	$39,233	$4,682	$39,991
		Sand Flat	91	0.4%	0.0	$0	1.70	$2,556	$25,558	$2,556	$25,558
		Verde	27	0.1%	1.3	$105	0.07	$104	$1,041	$209	$1,146
		West Bear/Del Rio	620	0.9%	32.3	$2,619	9.46	$14,196	$141,958	$16,815	$144,576
		Young	9	1.0%	1.4	$111	0.00	$0	$0	$111	$111
		Skeleton Ridge	361	0.8%	0.8	$68	6.77	$10,159	$101,590	$10,227	$101,658
2		Upper Campbell Blue	29	0.6%	0.8	$61	0.48	$726	$7,261	$787	$7,322
		PS	187	5.8%	21.2	$1,718	3.36	$5,037	$50,371	$6,755	$52,089
		Black River Allotment	109	0.8%	0.0	$0	1.61	$2,422	$24,216	$2,422	$24,216
	East Fork Black River	Sprucedale-Reno	10	1.4%	9.5	$771	0.00	$0	$0	$771	$771

COMPLEX	RIVER SEGMENT	ALLOTMENT NAME	CHD ACRES IN ALLOTMENT	PERCENT OF ALLOTMENT IN CHD	AUMS LOST[1]	VALUE OF LOST GRAZING[2]	LENGTH CHD (MI)	COSTS OF FENCE CONSTRUCTION (UNDISCOUNTED)		TOTAL PAST COSTS (UNDISCOUNTED)	
								LOW	HIGH	LOW	HIGH
	Boneyard Creek	Black River Allotment	94	0.7%	0.0	$0	1.44	$2,166	$21,662	$2,166	$21,662
	North East Fork Black River	Upper Campbell Blue	162	3.2%	4.2	$339	2.45	$3,672	$36,725	$4,012	$37,064
		Udall Allotment	65	3.9%	76.4	$6,191	0.95	$1,429	$14,289	$7,620	$20,480
		Black River Allotment	511	3.6%	0.0	$0	7.79	$11,680	$116,801	$11,680	$116,801
3	Aravaipa Creek	BLM-Painted Cave	1	0.0%	0.1	$5	0.00	$0	$0	$5	$5
		BLM-Hell Hole	43	2.1%	0.0	$0	0.07	$0	$0	$0	$0
		BLM-South Rim	677	1.6%	0.0	$0	10.47	$15,706	$157,059	$15,706	$157,059
		BLM-Brandenburg	15	0.5%	0.0	$0	0.23	$350	$3,505	$350	$3,505
		BLM-Allot has no name	12	10.6%	0.7	$66	0.18	$271	$2,712	$337	$2,778
	Gila River	BLM-Rafter 6	86	0.3%	0.0	$0	6.53	$0	$0	$0	$0
		BLM-Cochran	142	6.9%	8.5	$756	4.32	$6,484	$64,837	$7,240	$65,593
		BLM-Kearney	1	0.1%	0.0	$0	0.33	$0	$0	$0	$0
		BLM-Adiamond	88	0.4%	0.0	$0	5.11	$0	$0	$0	$0
		BLM-Teacup Ranch	67	0.2%	4.0	$356	2.31	$3,463	$34,628	$3,819	$34,984
		BLM-Len	127	0.3%	7.6	$676	0.53	$798	$7,979	$1,473	$8,654
	Deer Creek	BLM-Hell Hole	127	6.2%	0.0	$0	2.00	$0	$0	$0	$0
		BLM-South Rim	9	0.0%	0.0	$0	0.26	$390	$3,896	$390	$3,896
	Turkey Creek	BLM-South Rim	170	0.4%	0.0	$0	2.69	$4,034	$40,341	$4,034	$40,341

COMPLEX	RIVER SEGMENT	ALLOTMENT NAME	CHD ACRES IN ALLOTMENT	PERCENT OF ALLOTMENT IN CHD	AUMS LOST[1]	VALUE OF LOST GRAZING[2]	LENGTH CHD (MI)	COSTS OF FENCE CONSTRUCTION (UNDISCOUNTED)		TOTAL PAST COSTS (UNDISCOUNTED)	
								LOW	HIGH	LOW	HIGH
4		BLM-Morenci	5	0.0%	0.1	$11	0.07	$112	$1,119	$123	$1,130
		Dark Canyon	148	26.2%	94.2	$7,633	2.47	$3,711	$37,107	$11,344	$44,740
		East Eagle	111	3.1%	147.2	$11,926	1.73	$2,592	$25,922	$14,518	$37,848
	Eagle Creek	Tule	17	1.6%	13.8	$1,119	0.30	$446	$4,455	$1,564	$5,574
	San Francisco River	BLM-Metcalf	68	0.2%	0.2	$15	0.61	$916	$9,163	$932	$9,178
		BLM-San Francisco	130	2.3%	13.2	$1,174	1.97	$2,958	$29,576	$4,131	$30,749
		BLM_Morenci	193	0.6%	5.0	$446	3.15	$4,725	$47,248	$5,171	$47,694
		BLM-Red Hickey Hills	0	0.0%	0.0	$0	0.00	$0	$0	$0	$0
		BLM-Smuggler Peak	148	1.6%	0.0	$0	2.36	$0	$0	$0	$0
		BLM-Gila	4	0.1%	0.0	$0	0.03	$0	$0	$0	$0
		Alma	141	0.7%	14.0	$1,137	2.36	$3,544	$35,438	$4,681	$36,575
		Devils Park	206	1.1%	8.2	$662	3.09	$4,630	$46,302	$5,292	$46,964
		Harden Cienega	126	0.3%	21.9	$1,772	2.52	$3,781	$37,806	$5,553	$39,578
		Dry Creek	190	0.4%	9.4	$762	2.85	$4,271	$42,709	$5,033	$43,471
		Pleasanton	156	0.6%	22.4	$1,818	0.27	$399	$3,989	$2,217	$5,808
		Kelly	520	2.2%	27.3	$2,213	0.23	$346	$3,458	$2,559	$5,671
		Big Horn	27	9.3%	5.3	$432	0.32	$481	$4,814	$913	$5,246
		Cedar Breaks	84	0.7%	13.0	$1,057	1.21	$1,810	$18,100	$2,867	$19,157
		Citizen	83	0.4%	19.3	$1,565	1.64	$2,465	$24,649	$4,030	$26,214
		Frisco Plaza	409	1.1%	9.6	$779	6.23	$9,346	$93,456	$10,125	$94,235
		Harve Gulch	293	3.1%	38.2	$3,094	4.51	$6,766	$67,663	$9,860	$70,757
		McCarty	29	1.1%	0.8	$65	0.48	$727	$7,271	$792	$7,336
		Potholes	62	0.8%	7.4	$599	0.00	$0	$0	$599	$599

COMPLEX	RIVER SEGMENT	ALLOTMENT NAME	CHD ACRES IN ALLOTMENT	PERCENT OF ALLOTMENT IN CHD	AUMS LOST[1]	VALUE OF LOST GRAZING[2]	LENGTH CHD (MI)	COSTS OF FENCE CONSTRUCTION (UNDISCOUNTED)		TOTAL PAST COSTS (UNDISCOUNTED)	
								LOW	HIGH	LOW	HIGH
		Pueblo Creek	1	0.0%	0.1	$7	0.00	$0	$0	$7	$7
		Roberts Park	91	0.5%	26.3	$2,133	0.99	$1,491	$14,908	$3,624	$17,041
		Whiterocks	14	0.2%	0.1	$4	0.23	$352	$3,518	$356	$3,523
		Black Bob	316	1.1%	13.4	$1,087	1.00	$1,493	$14,932	$2,581	$16,020
		Copperas	28	0.3%	5.6	$450	0.27	$412	$4,120	$862	$4,570
		Wildbunch	26	0.9%	31.9	$2,584	0.25	$373	$3,728	$2,957	$6,312
		Turkey Creek	169	1.7%	5.6	$457	2.42	$3,628	$36,277	$4,084	$36,734
		Luna	27	0.1%	2.2	$177	0.45	$673	$6,729	$850	$6,907
	Campbell Blue Creek	Lower Campbell	262	2.7%	0.0	$0	3.90	$5,850	$58,499	$5,850	$58,499
		Bobcat-Johnson	232	3.9%	6.2	$502	4.29	$6,431	$64,306	$6,933	$64,808
		Cow Flat	18	0.1%	1.4	$113	0.37	$553	$5,527	$666	$5,640
		Bush Creek	15	49.8%	10.5	$848	0.23	$340	$3,402	$1,188	$4,250
		Steeple Mesa	19	13.5%	0.0	$0	0.49	$740	$7,401	$740	$7,401
	Blue River	Luna	21	0.0%	0.9	$74	0.35	$528	$5,275	$602	$5,350
	Frieborn Creek	Luna	65	0.1%	2.8	$227	1.10	$1,650	$16,497	$1,876	$16,724
	Pace Creek	Luna	50	0.1%	2.1	$174	0.77	$1,161	$11,607	$1,334	$11,781
		Eagle Peak	185	0.8%	11.2	$906	3.01	$4,512	$45,119	$5,418	$46,026
		Frisco Plaza	17	0.0%	0.4	$32	0.06	$86	$859	$118	$891
	Negrito Creek	McCarty	11	0.4%	0.3	$25	0.20	$302	$3,024	$327	$3,049
	Tularosa River	Alexander	88	0.2%	7.8	$630	1.37	$2,062	$20,622	$2,692	$21,252
		Deep Canyon	226	1.0%	4.4	$354	3.44	$5,160	$51,603	$5,514	$51,957
		Eagle Peak	23	0.1%	1.4	$113	0.28	$416	$4,163	$529	$4,276
		Frisco Plaza	76	0.2%	1.8	$144	1.05	$1,575	$15,752	$1,720	$15,897
		Lower Plaza	17	0.4%	0.8	$61	0.32	$475	$4,751	$536	$4,812

COMPLEX	RIVER SEGMENT	ALLOTMENT NAME	CHD ACRES IN ALLOTMENT	PERCENT OF ALLOTMENT IN CHD	AUMS LOST[1]	VALUE OF LOST GRAZING[2]	LENGTH CHD (MI)	COSTS OF FENCE CONSTRUCTION (UNDISCOUNTED)		TOTAL PAST COSTS (UNDISCOUNTED)	
								LOW	HIGH	LOW	HIGH
		McCarty	62	2.4%	1.7	$137	0.96	$1,446	$14,458	$1,582	$14,594
	Dry Blue Creek	Luna	188	0.4%	8.1	$655	2.95	$4,426	$44,260	$5,081	$44,915
5		BLM-01004	4	0.0%	0.2	$20	0.00	$0	$0	$20	$20
		BLM-01011	76	1.9%	4.6	$406	0.62	$930	$9,302	$1,337	$9,709
		BLM-01016	46	1.6%	2.8	$245	0.65	$973	$9,731	$1,218	$9,976
		BLM-1037	463	0.5%	27.8	$2,472	7.07	$10,598	$105,980	$13,070	$108,452
		BLM-01045	23	0.3%	1.4	$124	0.05	$82	$820	$206	$944
		BLM-01047	119	0.5%	7.1	$636	2.27	$3,405	$34,050	$4,041	$34,686
		BLM-01051	55	0.8%	3.3	$291	0.79	$1,191	$11,912	$1,483	$12,204
		BLM-01059	13	0.0%	0.8	$67	0.09	$136	$1,361	$203	$1,428
		BLM-01078	11	0.0%	0.7	$60	0.14	$213	$2,135	$274	$2,195
		BLM-04537	17	0.1%	1.0	$89	0.26	$388	$3,878	$476	$3,966
		Little Rough	6	0.2%	0.3	$22	0.00	$0	$0	$22	$22
		Redstone	856	1.3%	0.0	$0	12.74	$19,110	$191,099	$19,110	$191,099
		Brock Canyon	859	8.3%	0.0	$0	13.13	$19,701	$197,007	$19,701	$197,007
		Gila River	657	3.7%	52.0	$4,211	10.16	$15,238	$152,378	$19,449	$156,589
		Mangas/ Silverdale	0	0.0%	0.0	$1	0.00	$0	$0	$1	$1
		Reading Mountain	0	0.0%	0.0	$0	0.00	$0	$0	$0	$0
		Watson Mountain	215	2.5%	0.0	$0	3.16	$4,733	$47,332	$4,733	$47,332
	Upper Gila	XSX	398	1.8%	6.4	$520	5.88	$8,824	$88,238	$9,344	$88,758
	East Fork Gila River	Diamond Bar	566	0.4%	0.0	$0	8.77	$13,149	$131,492	$13,149	$131,492
		Jordan Mesa	453	1.1%	0.0	$0	6.87	$10,302	$103,021	$10,302	$103,021
		Taylor Creek	36	0.1%	0.0	$0	0.44	$663	$6,628	$663	$6,628

COMPLEX	RIVER SEGMENT	ALLOTMENT NAME	CHD ACRES IN ALLOTMENT	PERCENT OF ALLOTMENT IN CHD	AUMS LOST[1]	VALUE OF LOST GRAZING[2]	LENGTH CHD (MI)	COSTS OF FENCE CONSTRUCTION (UNDISCOUNTED)		TOTAL PAST COSTS (UNDISCOUNTED)	
								LOW	HIGH	LOW	HIGH
		Sapillo	65	0.1%	0.2	$20	0.79	$1,186	$11,859	$1,206	$11,879
		XSX	252	1.1%	4.1	$330	3.81	$5,712	$57,125	$6,043	$57,455
	Middle Fork Gila River	Jordan Mesa	2	0.0%	0.0	$0	7.76	$11,635	$116,354	$11,635	$116,354
		XSX	23	0.1%	0.4	$30	0.04	$62	$617	$92	$646
	West Fork Gila River	XSX	55	0.2%	0.9	$72	0.85	$1,269	$12,691	$1,341	$12,763
		Total	**17406**		**1086.6**	**$88,724**	**268.86**	**$378,654**	**$3,786,543**	**$467,379**	**$3,875,268**

Source: IEc analysis

Notes:

[1] Number of AUMs lost was calculated by multiplying total number of AUMS grazed in the allotment by the percent of the allotment located within proposed CHD.

[2] AUMs are valued at $81 per AUM for USFS allotments and $89 for BLM allotments. (See Exhibit 4-4.)

[3] Total costs of fence construction were calculated based on a low estimate of $1,500 per mile of fencing and a high estimate of $15,000 per mile of fencing. (See Exhibit 4-10).

EXHIBIT C-2. FUTURE COSTS BY ALLOTMENT

COMPLEX	RIVER SEGMENT	ALLOTMENT NAME	LENGTH CHD (MI)	ANNUAL COSTS OF FENCE MAINTENANCE (UNDISCOUNTED)[1]		TOTAL COSTS OF FENCE MAINTENANCE (UNDISCOUNTED)		TOTAL COSTS OF FENCE MAINTENANCE (7% DISCOUNT RATE)		TOTAL COSTS OF FENCE MAINTENANCE (3% DISCOUNT RATE)	
				LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH
		Fossil Creek	1.64	$180	$4,259	$3,604	$85,177	$1,909	$45,118	$2,681	$63,361
		Hackberry/Pivot Rock	4.91	$540	$12,768	$10,804	$255,368	$5,723	$135,269	$8,037	$189,962
		Ikes Backbone	0.17	$18	$436	$369	$8,724	$196	$4,621	$275	$6,490
		Thirteen-Mile Rock	0.00	$0	$0	$0	$0	$0	$0	$0	$0
		Antelope Hills	13.12	$1,443	$34,104	$28,858	$682,087	$15,286	$361,302	$21,466	$507,387
		Brown Springs	9.64	$1,061	$25,067	$21,211	$501,342	$11,235	$265,561	$15,778	$372,935
		China Dam	3.05	$335	$7,924	$6,705	$158,473	$3,551	$83,943	$4,987	$117,884
		Horseshoe	3.41	$375	$8,854	$7,492	$177,089	$3,969	$93,804	$5,573	$131,732
		Jerome	0.00	$0	$0	$0	$0	$0	$0	$0	$0
		Muldoon	3.69	$406	$9,598	$8,121	$191,953	$4,302	$101,678	$6,041	$142,789
		Perkinsville	2.62	$288	$6,800	$5,754	$136,007	$3,048	$72,043	$4,280	$101,172
		Sand Flat	1.70	$187	$4,430	$3,748	$88,600	$1,986	$46,931	$2,788	$65,907
		Verde	0.07	$8	$181	$153	$3,610	$81	$1,912	$114	$2,686
		West Bear/Del Rio	9.46	$1,041	$24,606	$20,820	$492,120	$11,029	$260,676	$15,488	$366,075
		Young	0.00	$0	$0	$0	$0	$0	$0	$0	$0
1	Verde River	Skeleton Ridge	6.77	$745	$17,609	$14,900	$352,177	$7,892	$186,549	$11,084	$261,975
2		Upper Campbell Blue	0.48	$53	$1,259	$1,065	$25,172	$564	$13,333	$792	$18,725
		PS	3.36	$369	$8,731	$7,388	$174,618	$3,913	$92,495	$5,496	$129,894
	East Fork Black River	Black River Allotment	1.61	$178	$4,197	$3,552	$83,949	$1,881	$44,468	$2,642	$62,447
		Sprucedale-Reno	0.00	$0	$0	$0	$0	$0	$0	$0	$0
	Boneyard Creek	Black River Allotment	1.44	$159	$3,755	$3,177	$75,095	$1,683	$39,778	$2,363	$55,861

COMPLEX	RIVER SEGMENT	ALLOTMENT NAME	LENGTH CHD (MI)	ANNUAL COSTS OF FENCE MAINTENANCE (UNDISCOUNTED)[1]		TOTAL COSTS OF FENCE MAINTENANCE (UNDISCOUNTED)		TOTAL COSTS OF FENCE MAINTENANCE (7% DISCOUNT RATE)		TOTAL COSTS OF FENCE MAINTENANCE (3% DISCOUNT RATE)	
				LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH
	North East Fork Black River	Upper Campbell Blue	2.45	$269	$6,366	$5,386	$127,312	$2,853	$67,437	$4,007	$94,704
		Udall Allotment	0.95	$105	$2,477	$2,096	$49,536	$1,110	$26,239	$1,559	$36,848
		Black River Allotment	7.79	$857	$20,246	$17,131	$404,912	$9,074	$214,482	$12,743	$301,203
	Aravaipa Creek	BLM-Painted Cave	0.00	$0	$0	$0	$0	$0	$0	$0	$0
		BLM-Hell Hole[2]	0.07	$8	$187	$580	$5,143	$307	$2,724	$431	$3,825
		BLM-South Rim	10.47	$1,152	$27,224	$23,035	$544,471	$12,202	$288,407	$17,135	$405,017
		BLM-Brandenburg	0.23	$26	$607	$514	$12,150	$272	$6,436	$382	$9,038
		BLM-Allot has no name	0.18	$20	$470	$398	$9,403	$211	$4,981	$296	$6,995
	Gila River	BLM-Rafter 6[2]	6.53	$718	$16,967	$24,616	$437,708	$13,039	$231,854	$18,311	$325,599
		BLM-Cochran	4.32	$475	$11,238	$9,509	$224,768	$5,037	$119,060	$7,074	$167,199
		BLM-Kearney[2]	0.33	$36	$847	$1,212	$21,823	$642	$11,560	$901	$16,234
		BLM-Adiamond[2]	5.11	$562	$13,274	$19,134	$342,307	$10,135	$181,321	$14,233	$254,634
		BLM-Teacup Ranch	2.31	$254	$6,002	$5,079	$120,042	$2,690	$63,586	$3,778	$89,296
		BLM-Len	0.53	$59	$1,383	$1,170	$27,660	$620	$14,651	$870	$20,575
	Deer Creek	BLM-Hell Hole[2]	2.00	$220	$5,206	$8,337	$135,073	$4,416	$71,548	$6,202	$100,477
		BLM-South Rim-4529	0.26	$29	$675	$571	$13,507	$303	$7,155	$425	$10,047
3	Turkey Creek	BLM-South Rim	2.69	$296	$6,992	$5,917	$139,850	$3,134	$74,079	$4,401	$104,031
4	Eagle Creek	BLM-Morenci	0.07	$8	$194	$164	$3,878	$87	$2,054	$122	$2,884
		Dark Canyon	2.47	$272	$6,432	$5,442	$128,637	$2,883	$68,139	$4,048	$95,690
		East Eagle	1.73	$190	$4,493	$3,802	$89,862	$2,014	$47,600	$2,828	$66,846
		Tule	0.30	$33	$772	$653	$15,446	$346	$8,182	$486	$11,490
	San Francisco River	BLM-Metcalf	0.61	$67	$1,588	$1,344	$31,763	$712	$16,825	$1,000	$23,628
		BLM-San Francisco	1.97	$217	$5,126	$4,338	$102,529	$2,298	$54,309	$3,227	$76,268

COMPLEX	RIVER SEGMENT	ALLOTMENT NAME	LENGTH CHD (MI)	ANNUAL COSTS OF FENCE MAINTENANCE (UNDISCOUNTED)[1]		TOTAL COSTS OF FENCE MAINTENANCE (UNDISCOUNTED)		TOTAL COSTS OF FENCE MAINTENANCE (7% DISCOUNT RATE)		TOTAL COSTS OF FENCE MAINTENANCE (3% DISCOUNT RATE)	
				LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH
		BLM-Morenci	3.15	$346	$8,190	$6,930	$163,794	$3,671	$86,762	$5,155	$121,842
		BLM-Red Hickey Hills	0.00	$0	$0	$0	$0	$0	$0	$0	$0
		BLM-Smuggler Peak[2]	2.36	$260	$6,144	$42,391	$160,077	$22,454	$84,793	$31,533	$119,077
		BLM-Gila[2]	0.03	$4	$89	$610	$2,312	$323	$1,225	$454	$1,720
		Alma	2.36	$260	$6,143	$5,198	$122,853	$2,753	$65,075	$3,866	$91,387
		Devils Park	3.09	$340	$8,026	$6,791	$160,514	$3,597	$85,025	$5,052	$119,403
		Harden Cienega	2.52	$277	$6,553	$5,545	$131,061	$2,937	$69,423	$4,125	$97,493
		Dry Creek	2.85	$313	$7,403	$6,264	$148,058	$3,318	$78,427	$4,660	$110,137
		Pleasanton	0.27	$29	$691	$585	$13,830	$310	$7,326	$435	$10,288
		Kelly	0.23	$25	$599	$507	$11,988	$269	$6,350	$377	$8,918
		Big Horn	0.32	$35	$834	$706	$16,688	$374	$8,840	$525	$12,414
		Cedar Breaks	1.21	$133	$3,137	$2,655	$62,747	$1,406	$33,237	$1,975	$46,676
		Citizen	1.64	$181	$4,273	$3,615	$85,450	$1,915	$45,263	$2,689	$63,564
		Frisco Plaza	6.23	$685	$16,199	$13,707	$323,979	$7,261	$171,612	$10,196	$241,000
		Harve Gulch	4.51	$496	$11,728	$9,924	$234,565	$5,257	$124,249	$7,382	$174,487
		McCarty	0.48	$53	$1,260	$1,066	$25,205	$565	$13,351	$793	$18,750
		Potholes	0.00	$0	$0	$0	$0	$0	$0	$0	$0
		Pueblo Creek	0.00	$0	$0	$0	$0	$0	$0	$0	$0
		Roberts Park	0.99	$109	$2,584	$2,186	$51,680	$1,158	$27,375	$1,626	$38,443
		Whiterocks	0.23	$0	$610	$0	$12,197	$0	$6,461	$0	$9,073
		Black Bob	1.00	$110	$2,588	$2,190	$51,765	$1,160	$27,420	$1,629	$38,507
		Copperas	0.27	$30	$714	$604	$14,282	$320	$7,565	$449	$10,624
		Wildbunch	0.25	$27	$646	$547	$12,925	$290	$6,846	$407	$9,615

COMPLEX	RIVER SEGMENT	ALLOTMENT NAME	LENGTH CHD (MI)	ANNUAL COSTS OF FENCE MAINTENANCE (UNDISCOUNTED)[1]		TOTAL COSTS OF FENCE MAINTENANCE (UNDISCOUNTED)		TOTAL COSTS OF FENCE MAINTENANCE (7% DISCOUNT RATE)		TOTAL COSTS OF FENCE MAINTENANCE (3% DISCOUNT RATE)	
				LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH
	Campbell Blue Creek	Turkey Creek	2.42	$266	$6,288	$5,321	$125,761	$2,818	$66,616	$3,958	$93,551
		Luna	0.45	$49	$1,166	$987	$23,329	$523	$12,357	$734	$17,354
		Lower Campbell	3.90	$429	$10,140	$8,580	$202,795	$4,545	$107,421	$6,382	$150,854
	Blue River	Bobcat-Johnson	4.29	$472	$11,146	$9,431	$222,926	$4,996	$118,084	$7,016	$165,829
		Cow Flat	0.37	$41	$958	$811	$19,161	$429	$10,150	$603	$14,254
		Bush Creek	0.23	$25	$590	$499	$11,794	$264	$6,247	$371	$8,773
		Steeple Mesa	0.49	$54	$1,283	$1,085	$25,656	$575	$13,590	$807	$19,085
		Luna	0.35	$39	$914	$774	$18,287	$410	$9,687	$576	$13,604
	Frieborn Creek	Luna	1.10	$121	$2,860	$2,420	$57,191	$1,282	$30,294	$1,800	$42,543
	Pace Creek	Luna	0.77	$85	$2,012	$1,702	$40,239	$902	$21,315	$1,266	$29,933
	Negrito Creek	Eagle Peak	3.01	$331	$7,821	$6,618	$156,414	$3,505	$82,853	$4,923	$116,352
		Frisco Plaza	0.06	$6	$149	$126	$2,977	$67	$1,577	$94	$2,215
		McCarty	0.20	$22	$524	$443	$10,483	$235	$5,553	$330	$7,798
	Tularosa River	Alexander	1.37	$151	$3,574	$3,024	$71,488	$1,602	$37,867	$2,250	$53,178
		Deep Canyon	3.44	$378	$8,945	$7,568	$178,891	$4,009	$94,759	$5,630	$133,072
		Eagle Peak	0.28	$31	$722	$611	$14,431	$323	$7,644	$454	$10,735
		Frisco Plaza	1.05	$116	$2,730	$2,310	$54,608	$1,224	$28,926	$1,719	$40,622
		Lower Plaza	0.32	$35	$824	$697	$16,471	$369	$8,725	$518	$12,253
		McCarty	0.96	$106	$2,506	$2,120	$50,119	$1,123	$26,548	$1,577	$37,283
	Dry Blue Creek	Luna	2.95	$325	$7,672	$6,491	$153,434	$3,439	$81,274	$4,829	$114,135
5	Upper Gila	BLM-01004	0.00	$0	$0	$0	$0	$0	$0	$0	$0
		BLM-01011	0.62	$68	$1,612	$1,364	$32,248	$723	$17,082	$1,015	$23,989
		BLM-01016	0.65	$71	$1,687	$1,427	$33,735	$756	$17,869	$1,062	$25,094
		BLM-1037	7.07	$777	$18,370	$15,544	$367,397	$8,234	$194,610	$11,563	$273,297
		BLM-01045	0.05	$6	$142	$120	$2,844	$64	$1,506	$89	$2,115

COMPLEX	RIVER SEGMENT	ALLOTMENT NAME	LENGTH CHD (MI)	ANNUAL COSTS OF FENCE MAINTENANCE (UNDISCOUNTED)[1]		TOTAL COSTS OF FENCE MAINTENANCE (UNDISCOUNTED)		TOTAL COSTS OF FENCE MAINTENANCE (7% DISCOUNT RATE)		TOTAL COSTS OF FENCE MAINTENANCE (3% DISCOUNT RATE)	
				LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH
		BLM-01047	2.27	$250	$5,902	$4,994	$118,039	$2,645	$62,525	$3,715	$87,806
		BLM-01051	0.79	$87	$2,065	$1,747	$41,296	$925	$21,874	$1,300	$30,719
		BLM-01059	0.09	$10	$236	$200	$4,718	$106	$2,499	$148	$3,509
		BLM-01078	0.14	$16	$370	$313	$7,400	$166	$3,920	$233	$5,504
		BLM-04537	0.26	$28	$672	$569	$13,442	$301	$7,120	$423	$9,999
		Little Rough	0.00	$0	$0	$0	$0	$0	$0	$0	$0
		Redstone	12.74	$1,401	$33,124	$28,028	$662,475	$14,846	$350,914	$20,849	$492,798
		Brock Canyon	13.13	$1,445	$34,148	$28,894	$682,958	$15,305	$361,764	$21,494	$508,035
		Gila River	10.16	$1,117	$26,412	$22,349	$528,244	$11,838	$279,811	$16,625	$392,947
		Mangas/Silverdale	0.00	$0	$0	$0	$0	$0	$0	$0	$0
		Reading Mountain	0.00	$0	$0	$0	$0	$0	$0	$0	$0
		Watson Mountain	3.16	$347	$8,204	$6,942	$164,083	$3,677	$86,915	$5,164	$122,057
		XSX	5.88	$647	$15,295	$12,942	$305,892	$6,855	$162,031	$9,627	$227,545
	East Fork Gila River	Diamond Bar	8.77	$964	$22,792	$19,285	$455,837	$10,216	$241,457	$14,346	$339,085
		Jordan Mesa	6.87	$755	$17,857	$15,110	$357,139	$8,004	$189,177	$11,240	$265,666
		Taylor Creek	0.44	$49	$1,149	$972	$22,976	$515	$12,171	$723	$17,091
		Sapillo	0.79	$87	$2,056	$1,739	$41,112	$921	$21,777	$1,294	$30,582
		XSX	3.81	$419	$9,902	$8,378	$198,033	$4,438	$104,898	$6,232	$147,312
	Middle Fork Gila River	Jordan Mesa	7.76	$853	$20,168	$17,065	$403,361	$9,039	$213,660	$12,694	$300,049
		XSX	0.04	$5	$107	$90	$2,137	$48	$1,132	$67	$1,590
	West Fork Gila River	XSX	0.85	$93	$2,200	$1,861	$43,995	$986	$23,304	$1,385	$32,727
		Total	**268.86**	**$29,549**	**$699,048**	**$651,723**	**$14,231,128**	**$313,046**	**$7,405,730**	**$439,619**	**$10,400,076**

Source: IEc analysis

[1] Annual costs of fence maintenance were calculated based on a low estimate of $110 per mile of fencing and a high estimate of $2,600 per mile of fencing (see Exhibit 4-10).

[2] These allotments are currently grazed, estimates of future costs include value of AUMs lost (valued at $89 per AUM) and value of fence construction calculated based on a low estimate of $1,500 per mile of fencing and a high end estimate of $15,000 per mile of fencing (see Exhibit 4-10).

APPENDIX D:

SUMMARY OF QUANTIFIED FUTURE COSTS BY RIVER SEGMENT IN PROPOSED CHD, 2006-2025

COMPLEX	RIVER SEGMENT	FUTURE (UNDISCOUNTED DOLLARS)		FUTURE PRESENT VALUE 3%		FUTURE PRESENT VALUE 7%		ANNUALIZED (3%)		ANNUALIZED (7%)	
		LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH
Complex 1	Verde River	$11,729,000	$64,890,000	$8,888,000	$55,312,000	$6,472,000	$46,899,000	$603,000	$3,731,000	$625,000	$4,461,000
	Boneyard Creek	$3,000	$75,000	$2,000	$56,000	$2,000	$40,000	$0	$4,000	$0	$4,000
	East Fork Black River	$89,000	$476,000	$66,000	$354,000	$47,000	$252,000	$6,000	$27,000	$8,000	$32,000
	N.East Fork Black River	$102,000	$774,000	$75,000	$576,000	$54,000	$410,000	$6,000	$42,000	$8,000	$47,000
Complex 2	East Fork White River	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Aravaipa Creek	$2,912,000	$6,687,000	$2,165,000	$5,681,000	$1,542,000	$4,803,000	$147,000	$385,000	$149,000	$462,000
	Deer Creek	$9,000	$149,000	$4,000	$87,000	$3,000	$62,000	$0	$6,000	$0	$6,000
	Turkey Creek	$6,000	$140,000	$4,000	$104,000	$3,000	$74,000	$0	$7,000	$0	$7,000
	Gila River	$2,878,000	$4,107,000	$2,127,000	$2,921,000	$1,515,000	$2,080,000	$144,000	$200,000	$146,000	$205,000
Complex 3	San Pedro River	$0	$4,459,000	$0	$4,329,000	$0	$4,167,000	$0	$291,000	$0	$393,000
	Eagle Creek	$256,000	$790,000	$190,000	$588,000	$136,000	$418,000	$17,000	$48,000	$22,000	$62,000
	San Francisco River	$790,000	$3,172,000	$560,000	$2,334,000	$398,000	$1,664,000	$43,000	$171,000	$52,000	$194,000
	Tularosa River	$104,000	$474,000	$77,000	$352,000	$55,000	$251,000	$5,000	$24,000	$5,000	$24,000
	Frieborn Creek	$2,000	$57,000	$2,000	$43,000	$1,000	$30,000	$0	$3,000	$0	$3,000
	Negrito Creek	$95,000	$257,000	$70,000	$191,000	$50,000	$136,000	$5,000	$13,000	$5,000	$13,000
	Whitewater Creek	$88,000	$88,000	$65,000	$65,000	$46,000	$46,000	$4,000	$4,000	$4,000	$4,000
	Blue River	$4,573,000	$5,608,000	$3,565,000	$4,335,000	$2,681,000	$3,230,000	$247,000	$310,000	$272,000	$353,000
	Campbell Blue Creek	$41,000	$416,000	$30,000	$310,000	$22,000	$220,000	$3,000	$22,000	$3,000	$24,000
	Little Blue Creek	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Dry Blue Creek	$6,000	$153,000	$5,000	$114,000	$3,000	$81,000	$0	$8,000	$0	$8,000
Complex 4	Pace Creek	$2,000	$40,000	$1,000	$30,000	$1,000	$21,000	$0	$2,000	$0	$2,000
	East Fork Gila River	$193,000	$1,544,000	$155,000	$1,161,000	$122,000	$838,000	$10,000	$78,000	$11,000	$79,000
	Upper Gila River	$213,000	$3,640,000	$158,000	$2,841,000	$113,000	$2,166,000	$11,000	$191,000	$11,000	$204,000
	Middle Fork Gila River	$165,000	$553,000	$134,000	$423,000	$107,000	$313,000	$9,000	$28,000	$10,000	$29,000
Complex 5	West Fork Gila River	$649,000	$948,000	$430,000	$735,000	$365,000	$552,000	$29,000	$49,000	$34,000	$52,000
	Multiple	$333,000	$833,000	$248,000	$620,000	$176,000	$441,000	$22,000	$56,000	$31,000	$79,000
GRAND TOTAL		**$25,238,000**	**$100,330,000**	**$19,021,000**	**$83,562,000**	**$13,914,000**	**$69,194,000**	**$1,311,000**	**$5,700,000**	**$1,396,000**	**$6,747,000**