

**FINAL DRAFT ECONOMIC ANALYSIS
OF CRITICAL HABITAT DESIGNATION
FOR THE GILA CHUB**

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EXECUTIVE SUMMARY

1. The purpose of this report is to estimate the economic impact of actions taken to protect the federally-listed Gila chub (*Gila intermedia*) and its 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 Gila chub was proposed to be listed, and it attempts to predict future costs likely to occur after the 2005 proposed CHD is finalized.

KEY FINDINGS

- **Total future impacts:** Quantified economic impacts are estimated to be \$11.4 million to \$28.1 million in undiscounted dollars over 20 years (\$0.8 million to \$1.9 million annually).¹
- **Activities most impacted:** Water impacts comprise the largest portion of potential impacts, or 57 percent of impacts using undiscounted dollar estimates. Other potential costs include costs to the San Carlos Apache Tribe (19 percent of estimated costs), livestock grazing (13 percent), species management efforts (8 percent), and transportation (3 percent).
 - **Water management:** Future impacts on water users resulting from Gila chub conservation activities may include between \$9.0 million to \$16.0 million (\$0.63 million and \$1.12 million annually) for the replacement of water from current water sources within proposed critical habitat. Of this amount, between \$2.6 to \$9.6 million (\$0.18 million and \$0.67 million annually) is for the City of Safford to replace water rights in the Middle Gila River Area and \$6.4 million (\$0.45 million annually) is for the Vail Water Company and BLM to replace water rights in the Lower Santa Cruz River Area. There is uncertainty about whether these volumes of water will be necessary to conserve Gila chub.²
 - **Livestock grazing (non-tribal):** Costs related to grazing conservation activities are estimated to range from \$451,000 to \$3.8 million. Approximately 16 small ranches, or 0.5 percent of ranches in counties that contain proposed CHD, could be impacted by conservation activities, assuming that each ranch is responsible for one affected allotment.
 - **San Carlos Apache:** Quantified impacts to livestock grazing and timber harvest activities are estimated to range from \$633,000 to \$5.4 million, although there is uncertainty regarding future activities on Tribal lands that could underestimate costs to the Tribe.
 - **Fire management and other activities:** This analysis estimates the total economic impact of Gila chub conservation efforts on species and habitat management, recreation, fire management, mining, and transportation activities to be \$1.3 million to \$2.9 million. Two percent of the critical habitat area is potential wildland and urban interface area (362 acres). On these acres, the potential risk of catastrophic wildfire could increase, if fire management activities are delayed or altered due to Gila chub conservation. Impacts on fire management activities include costs of evacuation and reestablishment of Gila chub populations in the event of a wildfire.
 - **Development:** Impacts to residential and commercial development are not anticipated.
- **Stream Reaches with highest impacts:** The stream reaches with the largest projected impacts are Bonita Creek (\$2.8 to \$11.5 million, or \$0.25 to \$1.02 million annually) and Cienega Creek (\$6.5 to \$7.1 million, or \$0.61 to \$0.64 million annually) for the next 20 years. Both of these reaches are long relative to other reaches, at 19 miles long each. Projected costs in these stream reaches primarily stem from water management costs.

¹ Total cost estimates included in the Key Finding section reflect total cost estimates in undiscounted dollars over 20 years. Annualized cost estimates included in the Key Findings section represent annualized values presented in 2004 dollars, assuming a discount rate of seven percent over 20 years.

² The Service expects to work with water users to maintain a minimum adequate streamflow for the Gila chub. Furthermore, at the Bonita Creek proposed CHD area, the Service believes that the City of Safford's infiltration gallery at the lower boundary of proposed CHD is actually a benefit to the Gila chub by acting as a barrier to the movement of nonnative species upstream. As such, the Service believes the scenario involving dramatic reductions in water usage is unlikely.

Background

2. On August 9, 2002, the U.S. Fish and Wildlife Service (Service) published a proposed critical habitat designation (CHD) for the Gila chub (*Gila intermedia*). The Service has proposed to designate critical habitat for the Gila chub on approximately 212 miles of stream in Arizona and New Mexico. Critical habitat includes the area of bankfull width plus 300 feet on either side of the banks.³ The proposed CHD is subdivided into seven areas and 28 stream reaches. Stream reaches vary from 0.4 miles to 25.1 miles in length (average of seven miles per reach). Of the approximately 15,500 acres comprising the proposed designation, approximately 59 percent are Federal lands and another 22 percent are privately owned. Of the remaining lands, approximately 5 percent are State lands and 14 percent are Tribal lands.⁴
3. 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.⁵ 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).⁶ 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.⁷
4. Executive Order 12866 directs Federal Agencies to evaluate regulatory alternatives.⁸ As stated above, the Service has identified seven separate areas of essential habitat containing 28 stream reaches of critical habitat. Consideration of impacts at a stream reach level may result in alternate combinations of essential habitat that may or may not ultimately be designated as critical habitat. Because this analysis presents costs by stream reach, the impacts of multiple combinations of essential habitat are also available to the Service.

³ The bankfull width of the stream is defined by the Service as the width of the stream or river at bankfull discharge, i.e. the flow at which water begins to leave the channel and move into the floodplain.

⁴ Note that this analysis present only approximate estimates of land acreage included in critical habitat areas, and these estimates may differ from those calculated using a linear extent. 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 developed by the Service. To estimate land ownership, geographic data of current land ownership was overlaid with CHD polygons using GIS analysis.

⁵ 16 U.S.C. §1533(b)(2).

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; 5 U.S.C. §§601 *et seq*; and Pub Law No. 104-121.

⁷ 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)).

⁸ Office of Management and Budget, Circular A-4, September 17, 2003, p. 7.

5. The economic 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). The analysis also addresses how potential economic impacts are likely to be distributed (distributional effects), including an assessment of local or regional impacts of Gila chub conservation and 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.

Results of the Analysis

6. The potential economic impacts of Gila chub proposed CHD stem from the current and proposed land uses in these areas. The proposed CHD generally consists of small tributary streams in rural areas, the majority of which are on public lands. Overall, there is little commercial or residential development planned in these areas. Instead, the majority of non-Federal affected entities consist of water users (primarily groundwater users), livestock producers (primarily ranchers with Federal grazing permits), and the San Carlos Apache Tribe. In addition, dispersed impacts on landowners and affected agencies to perform species monitoring and surveying activities are anticipated.
7. Exhibits ES-1 and ES-2 present total future costs over 20 years by activity and stream reach, respectively, in undiscounted dollars. Exhibits ES-3, ES-4, and ES-5 summarize the total future costs of Gila chub conservation activities anticipated over the next 20 years, presented in undiscounted dollars, as well as in present value terms, assuming discount rates of three and seven percent, respectively. The text that follows describes these costs in more detail, relying on the undiscounted dollar costs throughout the discussion.

Exhibit ES-1
UNDISCOUNTED DOLLAR FUTURE COSTS BY ACTIVITY (20 YEARS)

Total Costs:
\$11.4 million
to \$28.1
million

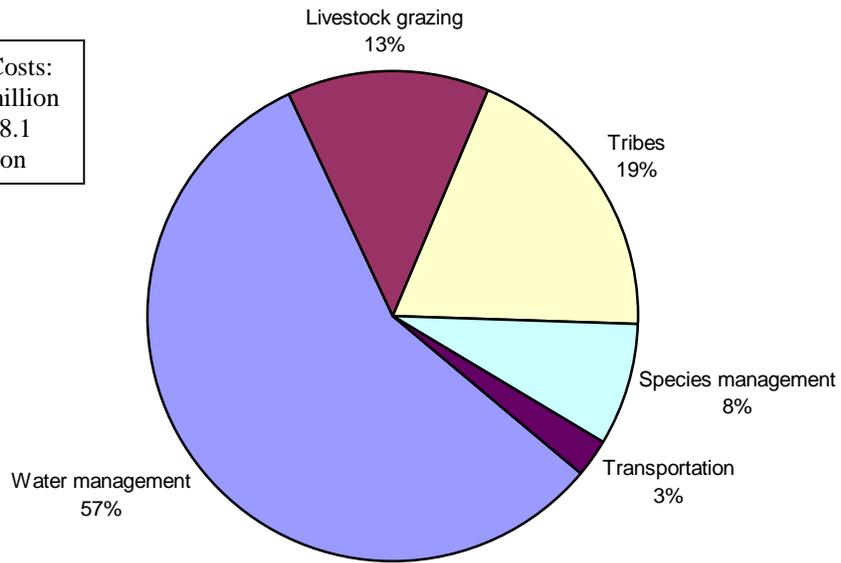
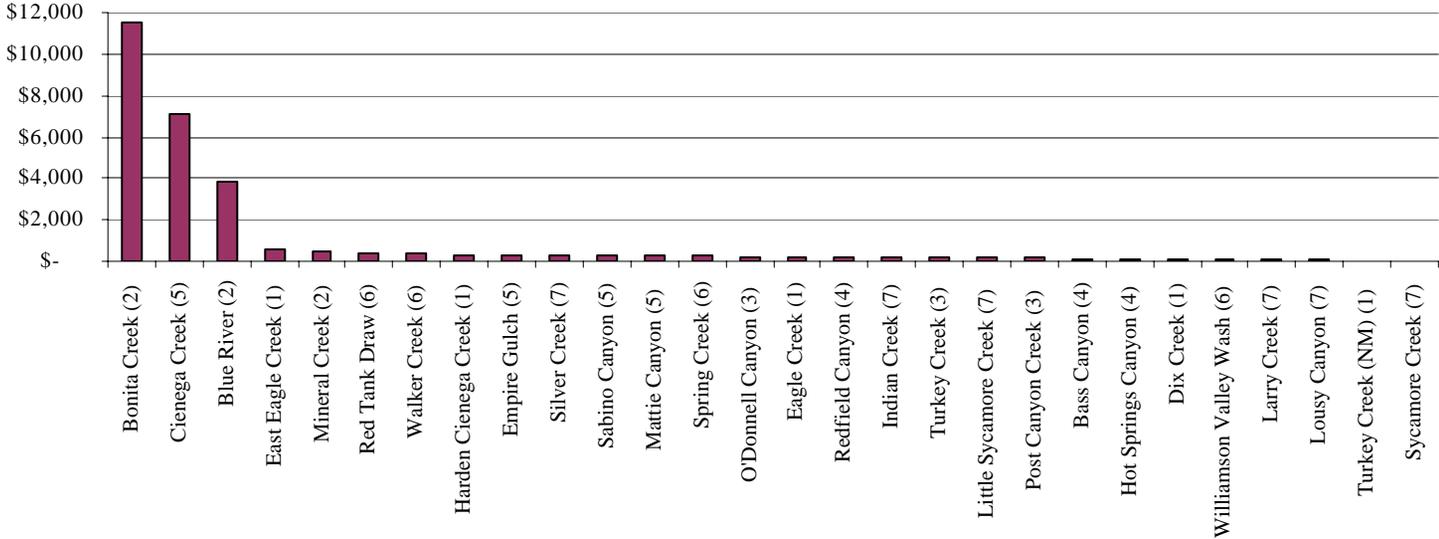


Exhibit ES-2

**TOTAL COSTS BY STREAM REACH (AREA) OVER 20 YEARS IN UNDISCOUNTED DOLLARS
(\$1000's)**



Water Management impacts may include between \$9.0 million and \$16.0 million for the replacement of water from current water sources within proposed CHD areas (undiscounted dollars). Of this amount, between \$2.6 million and \$9.6 million is for the City of Safford to replace water used in the Middle Gila River Area and \$6.4 million is for the Vail Water Company and BLM to replace water currently used in the Lower Santa Cruz River (undiscounted dollars). In the case of City of Safford, the volume of affected water could be between 3,876 acre-feet/year and 5,310 acre-feet/year, capable of serving between approximately 9,700 and 13,300 households.⁹ The volume of potentially affected water at the Vail Water Company is 1,355 acre-feet per year. Although the affected source is a groundwater well not currently used by the Company for water supply purposes, the Company could use water from the affected well in the future to supply its 5,415 customers.¹⁰ Similarly, although not currently used in public water supplies, BLM's potentially affected volume of 2,211 acre-feet per year could supply approximately 5,500 households in Arizona. Both the City of Safford and the Vail Water Company are considered small entities. Should these entities either be required or feel compelled to replace current water holdings in proposed CHD, annualized impacts could represent approximately between 2.3 and 5.3 percent of annual revenues to the City of Safford's Utility Department and between 74 and 174 percent of annual revenues to the Vail Water Company.

Livestock Grazing impacts 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 Gila chub conservation. The Service points out that in some cases, alternative management scenarios, such as seasonal rest combined with grazing rotation, can reduce impacts to Gila chub and reduce the need for additional riparian fencing.¹¹ To be conservative, this analysis assumes that landowners will implement

⁹ The Service believes that the City of Safford's existing infiltration gallery and water use is not adversely affecting the Gila chub. Furthermore, the Service believes that the infiltration gallery is actually a benefit to the Bonita Creek population of Gila chub because the ephemeral stretch acts as a barrier to the movement of nonnative species upstream. Written communication with the Service, Arizona Ecological Services Office, July 1, 2005.

¹⁰ It is worth noting that the Company plans on meeting future increases in water demand by drawing on other existing wells or drilling new wells rather than relying on the well in proposed CHD, thus reducing the likelihood of a need for water rights replacement in CHD areas.¹⁰ In addition, the Sonoran Desert Conservation Plan and Pima County may attempt to purchase the Vail Water Company well in question as part of an effort to restore streamflow in Cienega Creek. Thus, the company may be partially compensated for the replacement of these water rights regardless of Gila chub CHD. Therefore, it is difficult to estimate impacts on the Vail Water Company without knowing the actual out-of-pocket costs related to Gila chub conservation activities or any potential off-setting compensation from selling the well.

¹¹ Written communication with the Service, Arizona Ecological Services Office, July 1, 2005. For example, in the conference opinion issued for the Agua Fria National Monument, grazing rotation with seasonal rest combined with maintenance of existing fences, bank alteration limits, browsing limits, and herbaceous growth utilization limits were recommended in lieu of additional fencing (Service, "Formal Conference Opinion on the Existing Phoenix Resource Management Plan for the Agua Fria National Monument," July 14, 2004).

the more costly measures of installing and maintaining riparian fencing. This may result in an overestimate of future costs for some reaches.

Costs of constructing off-river drinking water devices as well as surveying and monitoring of fish and administrative costs are also included in cost estimates. Reductions in grazing effort on Federal lands (i.e., reduced permitted or authorized animal-unit months) are not estimated because less than five percent of the acres in each of the 16 allotments cross proposed CHD. Thus, this analysis assumes that small management changes and the creation of off-river drinking sources will be sufficient to replace access to riparian areas. Few private lands within proposed CHD are estimated to be used for grazing activities.

Over 20 years, costs related to grazing conservation activities are estimated to range from \$451,000 to \$3.8 million (undiscounted dollars). Approximately 16 small ranches could be impacted by conservation activities, assuming that each ranch is responsible for one affected allotment. These ranches would represent 0.5 percent of ranches in counties that contain proposed CHD. Annual ranch level impacts are estimated to range from \$1,400 to \$11,700 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. Grazing impacts are highest in Areas 1 and 5, with the highest stream reach impacts in East Eagle Creek in Apache-Sitgreaves National Forest, a relatively long reach at 14 miles long.

Residential and Commercial Development impacts are not anticipated. Based on the overall large distance of proposed CHD areas from cities, past and anticipated future population growth in nearby cities and towns, and plans laid out in existing County development plans, this analysis concludes that development is unlikely to occur in areas proposed for CHD.

San Carlos Apache Tribe: Two stream reaches cross San Carlos Apache lands: Bonita Creek and Blue River. Socioeconomic data suggest that the San Carlos Apache Tribe is economically vulnerable to future impacts from Gila chub conservation efforts. Future impacts resulting from Gila chub conservation activities on Tribal lands could include administrative costs of consultations, surveys and monitoring, development of a final Fisheries Management Plan, modifications to grazing, timber harvesting, fire management, and recreation activities, and potential project modifications to restoration activities. Impacts in each of these areas could affect the Tribe's revenues and employment in the future. Quantified impacts to livestock grazing and timber harvest activities are estimated to range from \$633,000 to \$5.4 million over 20 years, although there is uncertainty regarding future activities on Tribal lands (undiscounted dollars).

Transportation projects in the proposed CHD may cause sedimentation problems. During construction, roads may contribute to watershed problems through direct soil

disturbance. Established roads may also increase the sediments entering the stream through normal run-off. Approximately six roads cross the proposed critical habitat nine times. An estimated 16 projects will be impacted by Gila chub conservation activities: four on Forest Service roads and 12 on non-Forest Service roads. The future cost of Gila chub conservation measures for transportation projects are expected to range from \$86,000 to \$737,000 over 20 years (undiscounted dollars).

Recreation: Although OHV use, hunting, and fishing are important recreational activities in Arizona with significance for the Arizona economy, the remote nature and steep terrain of the areas proposed for critical habitat do not, in general, lend themselves to OHV use or hunting. In addition, several areas are closed to OHV use.¹² In those areas in which OHV use is not restricted, Gila chub conservation is unlikely to require changes to OHV activities. Fishing for Gila chub in Arizona and New Mexico is prohibited, and most Gila chub populations do not occur in popular fishing areas for other species. Therefore, this analysis does not anticipate large economic impacts to recreation activities from Gila chub conservation activities within the proposed CHD.

Mining: A considerable amount of Arizona's mining activity takes place in the counties that contain proposed critical habitat for the Gila chub. Only one mine location, however, is located in the proposed CHD for the Gila chub, on Mineral Creek, and it is undeveloped. Because development at this mine has not commenced, potential impacts of mining in this area are uncertain. One currently operating mine is located downstream of proposed CHD on Mineral Creek. This analysis assumes that no impacts to this mine are likely.

Fire Management is most likely to be affected by Gila chub conservation activities where Wildland-Urban Interface (WUI) areas overlap with the proposed CHD. This overlap occurs on 362 acres, or approximately two percent of proposed CHD. The majority of WUI area overlap occurs in Areas 5 and 6, in Spring Creek and Cienega Creek stream reaches. Expected impacts on fire management activities include administrative costs related to consultation on fire management plans, as well as cost of evacuation and reestablishment of Gila chub populations in the event of a wildfire. The total costs of Gila chub evacuation and reestablishment in the event of a wildfire is 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 Gila chub evacuation and reestablishment costs to stream reaches within the proposed CHD.

¹² For example, BLM does not allow OHV use up and down any of the stream reaches within proposed CHD.

Exhibit ES-3
SUMMARY OF FUTURE COSTS OF CONSERVATION ACTIVITIES FOR THE GILA CHUB
(Undiscounted Dollars, 2005-2024)

UNIT	STREAM REACH	Water Management		Livestock Grazing		Tribes		Development	Species Management		Recreation	Fire Management	Mining	Transportation	
		Low	High	Low	High	Low	High	(likelihood)	Low	High		(acres)		Low	High
Area 1: Upper Gila River	Turkey Creek (NM)	\$0	\$0	\$0	\$0	n/a	n/a	Unlikely	\$20,000	\$20,000	Modest	0	n/a	\$0	\$0
	Dix Creek	\$0	\$0	\$11,600	\$88,700	n/a	n/a	Unlikely	\$20,000	\$20,000	n/a	0	n/a	\$0	\$0
	Harden Cienega Creek (AZ/NM)	\$0	\$0	\$34,000	\$312,600	n/a	n/a	Unlikely	\$20,000	\$20,000	n/a	0	n/a	\$0	\$0
	Eagle Creek	\$0	\$0	\$13,600	\$108,800	n/a	n/a	Unlikely	\$50,000	\$108,000	n/a	0	n/a	\$0	\$0
	East Eagle Creek	\$0	\$0	\$61,700	\$562,300	n/a	n/a	Unlikely	\$20,000	\$20,000	n/a	0	n/a	\$0	\$0
	Subtotal	\$0	\$0	\$120,900	\$1,072,400	\$0	\$0	Unlikely	\$130,000	\$188,000	Modest	0	n/a	\$0	\$0
Area 2: Middle Gila River	Mineral Creek	\$0	\$0	\$39,200	\$354,200	n/a	n/a	Unlikely	\$50,000	\$108,000	n/a	0	Uncertain	\$0	\$0
	Blue River	\$0	\$0	\$0	\$0	\$527,000	\$3,738,000	Unlikely	\$80,000	\$138,000	n/a	0	n/a	\$0	\$0
	Bonita Creek	\$2,581,200	\$9,558,000	\$20,400	\$177,600	\$106,000	\$1,648,000	Unlikely	\$80,000	\$138,000	Unlikely	5	n/a	\$0	\$0
	Subtotal	\$2,581,200	\$9,558,000	\$59,600	\$531,800	\$633,000	\$5,386,000	Unlikely	\$210,000	\$384,000	Unlikely	5	n/a	\$0	\$0
Area 3: Babocomari River Area	O'Donnell Canyon	\$0	\$0	\$2,200	\$51,800	n/a	n/a	Unlikely	\$50,000	\$108,000	n/a	0	n/a	\$11,000	\$74,600
	Turkey Creek	\$0	\$0	\$0	\$0	n/a	n/a	Unlikely	\$50,000	\$108,000	n/a	0	n/a	\$11,000	\$74,600
	Post Canyon Creek	\$0	\$0	\$0	\$0	n/a	n/a	Unlikely	\$90,000	\$148,000	n/a	0	n/a	\$0	\$0
	Subtotal	\$0	\$0	\$2,200	\$51,800	\$0	\$0	Unlikely	\$190,000	\$364,000	n/a	0	n/a	\$22,000	\$149,200
Area 4: Lower San Pedro River Area	Bass Canyon	\$0	\$0	\$5,600	\$8,900	n/a	n/a	Unlikely	\$50,000	\$108,000	n/a	0	n/a	\$0	\$0
	Hot Springs Canyon	\$0	\$0	\$5,600	\$8,900	n/a	n/a	Unlikely	\$50,000	\$108,000	Unlikely	0	n/a	\$0	\$0
	Redfield Canyon	\$0	\$0	\$18,100	\$106,400	n/a	n/a	Unlikely	\$50,000	\$108,000	n/a	0	n/a	\$0	\$0
	Subtotal	\$0	\$0	\$29,300	\$124,200	\$0	\$0	Unlikely	\$150,000	\$324,000	Unlikely	0	n/a	\$0	\$0
Area 5: Lower Santa Cruz River Area	Cienega Creek	\$6,418,800	\$6,418,800	\$44,900	\$394,200	n/a	n/a	Unlikely	\$50,000	\$108,000	n/a	150	n/a	\$33,000	\$223,800
	Mattie Canyon	\$0	\$0	\$17,200	\$144,900	n/a	n/a	Unlikely	\$50,000	\$108,000	n/a	0	n/a	\$0	\$0
	Empire Gulch	\$0	\$0	\$19,500	\$167,800	n/a	n/a	Unlikely	\$50,000	\$108,000	n/a	0	n/a	\$0	\$0
	Sabino Canyon	\$0	\$0	\$26,800	\$240,400	n/a	n/a	Unlikely	\$20,000	\$20,000	Uncertain	1	n/a	\$0	\$0
	Subtotal	\$6,418,800	\$6,418,800	\$108,400	\$947,300	\$0	\$0	Unlikely	\$170,000	\$344,000	Uncertain	151	n/a	\$33,000	\$223,800
Area 6: Upper Verde River Area	Walker Creek	\$0	\$0	\$22,600	\$147,800	n/a	n/a	Unlikely	\$20,000	\$108,000	Unlikely	0	n/a	\$10,000	\$144,600
	Red Tank Draw	\$0	\$0	\$29,100	\$251,600	n/a	n/a	Unlikely	\$20,000	\$20,000	Unlikely	0	n/a	\$10,000	\$144,600
	Spring Creek	\$0	\$0	\$9,200	\$63,000	n/a	n/a	Unlikely	\$50,000	\$108,000	Unlikely	206	n/a	\$11,000	\$74,600
	Williamson Valley Wash	\$0	\$0	\$0	\$0	n/a	n/a	Unlikely	\$50,000	\$108,000	n/a	0	n/a	\$0	\$0
	Subtotal	\$0	\$0	\$60,900	\$462,400	\$0	\$0	Unlikely	\$140,000	\$344,000	Unlikely	206	n/a	\$31,000	\$363,800
Area 7: Aqua Fria River Area	Little Sycamore Creek	\$0	\$0	\$6,800	\$59,200	n/a	n/a	Unlikely	\$50,000	\$108,000	Unlikely	0	n/a	\$0	\$0
	Sycamore Creek	\$0	\$0	\$0	\$0	n/a	n/a	Unlikely	\$20,000	\$20,000	Unlikely	0	n/a	\$0	\$0
	Indian Creek	\$0	\$0	\$22,400	\$186,400	n/a	n/a	Unlikely	\$20,000	\$20,000	Unlikely	0	n/a	\$0	\$0
	Silver Creek	\$0	\$0	\$21,000	\$191,600	n/a	n/a	Unlikely	\$80,000	\$80,000	Unlikely	0	n/a	\$0	\$0
	Larry Creek	\$0	\$0	\$10,100	\$82,200	n/a	n/a	Unlikely	\$10,000	\$10,000	Unlikely	0	n/a	\$0	\$0
	Lousy Canyon	\$0	\$0	\$9,300	\$74,200	n/a	n/a	Unlikely	\$10,000	\$10,000	Unlikely	0	n/a	\$0	\$0
Subtotal	\$0	\$0	\$69,600	\$593,600	\$0	\$0	Unlikely	\$190,000	\$248,000	Unlikely	0	n/a	\$0	\$0	
Total		\$9,000,000	\$15,976,800	\$450,900	\$3,783,500	\$633,000	\$5,386,000	Unlikely	\$1,180,000	\$2,196,000	Modest	362	Uncertain	\$86,000	\$736,800
Grand Total (Low)		\$11,350,000													
Grand Total (High)		\$28,079,000													

Note: Estimates are not discounted.

Exhibit ES-4
SUMMARY OF FUTURE COSTS OF CONSERVATION ACTIVITIES FOR THE GILA CHUB
(2005-2024, Discounted at 3 percent)

UNIT	STREAM REACH	Water Management		Livestock Grazing		Tribes		Development (likelihood)	Species Management		Recreation	Fire Management (acres)	Mining	Transportation	
		Low	High	Low	High	Low	High		Low	High				Low	High
Area 1: Upper Gila River	Turkey Creek (NM)	\$0	\$0	\$0	\$0	n/a	n/a	Unlikely	\$1,000	\$1,000	Modest	0	n/a	\$0	\$0
	Dix Creek	\$0	\$0	\$8,600	\$66,000	n/a	n/a	Unlikely	\$1,000	\$1,000	n/a	0	n/a	\$0	\$0
	Harden Cienega Creek (AZ/NM)	\$0	\$0	\$25,300	\$232,500	n/a	n/a	Unlikely	\$1,000	\$1,000	n/a	0	n/a	\$0	\$0
	Eagle Creek	\$0	\$0	\$10,100	\$80,900	n/a	n/a	Unlikely	\$5,400	\$2,500	n/a	0	n/a	\$0	\$0
	East Eagle Creek	\$0	\$0	\$45,900	\$418,300	n/a	n/a	Unlikely	\$1,000	\$1,000	n/a	0	n/a	\$0	\$0
	Total	\$0	\$0	\$89,900	\$797,700	\$0	\$0	Unlikely	\$9,400	\$6,500	Modest	0	n/a	\$0	\$0
Area 2: Middle Gila River	Mineral Creek	\$0	\$0	\$29,200	\$263,500	n/a	n/a	Unlikely	\$5,400	\$2,500	n/a	0	Uncertain	\$0	\$0
	Blue River	\$0	\$0	n/a	n/a	\$413,300	\$2,982,900	Unlikely	\$6,900	\$4,000	n/a	0	n/a	\$0	\$0
	Bonita Creek	\$1,429,100	\$5,292,000	\$15,200	\$132,100	\$89,100	\$1,323,200	Unlikely	\$6,900	\$4,000	Unlikely	5	n/a	\$0	\$0
	Total	\$1,429,100	\$5,292,000	\$44,400	\$395,600	\$502,400	\$4,306,100	Unlikely	\$19,200	\$10,500	Unlikely	5	n/a	\$0	\$0
Area 3: Babocomari River Area	O'Donnell Canyon	\$0	\$0	\$1,600	\$38,500	n/a	n/a	Unlikely	\$5,400	\$2,500	n/a	0	n/a	\$8,200	\$55,500
	Turkey Creek	\$0	\$0	\$0	\$0	n/a	n/a	Unlikely	\$5,400	\$2,500	n/a	0	n/a	\$8,200	\$55,500
	Post Canyon Creek	\$0	\$0	\$0	\$0	n/a	n/a	Unlikely	\$7,900	\$5,800	n/a	0	n/a	\$0	\$0
	Total	\$0	\$0	\$1,600	\$38,500	\$0	\$0	Unlikely	\$18,700	\$10,800	n/a	0	n/a	\$16,400	\$111,000
Area 4: Lower San Pedro River Area	Bass Canyon	\$0	\$0	\$4,200	\$6,600	n/a	n/a	Unlikely	\$5,400	\$2,500	n/a	0	n/a	\$0	\$0
	Hot Springs Canyon	\$0	\$0	\$4,200	\$6,600	n/a	n/a	Unlikely	\$5,400	\$2,500	Unlikely	0	n/a	\$0	\$0
	Redfield Canyon	\$0	\$0	\$13,500	\$79,100	n/a	n/a	Unlikely	\$5,400	\$2,500	n/a	0	n/a	\$0	\$0
	Total	\$0	\$0	\$21,900	\$92,300	\$0	\$0	Unlikely	\$16,200	\$7,500	Unlikely	0	n/a	\$0	\$0
Area 5: Lower Santa Cruz River Area	Cienega Creek	\$3,553,900	\$3,553,900	\$33,400	\$293,200	n/a	n/a	Unlikely	\$5,400	\$2,500	n/a	150	n/a	\$24,500	\$166,500
	Mattie Canyon	\$0	\$0	\$12,800	\$107,800	n/a	n/a	Unlikely	\$5,400	\$2,500	n/a	0	n/a	\$0	\$0
	Empire Gulch	\$0	\$0	\$14,500	\$124,800	n/a	n/a	Unlikely	\$5,400	\$2,500	n/a	0	n/a	\$0	\$0
	Sabino Canyon	\$0	\$0	\$19,900	\$178,800	n/a	n/a	Unlikely	\$1,000	\$1,000	Uncertain	1	n/a	\$0	\$0
	Total	\$3,553,900	\$3,553,900	\$80,600	\$704,600	\$0	\$0	Unlikely	\$17,200	\$8,500	Uncertain	151	n/a	\$24,500	\$166,500
Area 6: Upper Verde River Area	Walker Creek	\$0	\$0	\$16,800	\$109,900	n/a	n/a	Unlikely	\$5,400	\$1,000	Unlikely	0	n/a	\$7,400	\$107,600
	Red Tank Draw	\$0	\$0	\$21,600	\$187,200	n/a	n/a	Unlikely	\$1,000	\$1,000	Unlikely	0	n/a	\$7,400	\$107,600
	Spring Creek	\$0	\$0	\$6,800	\$46,900	n/a	n/a	Unlikely	\$5,400	\$2,500	Unlikely	206	n/a	\$8,200	\$55,500
	Williamson Valley Wash	\$0	\$0	\$0	\$0	n/a	n/a	Unlikely	\$5,400	\$2,500	n/a	0	n/a	\$0	\$0
	Total	\$0	\$0	\$45,200	\$344,000	\$0	\$0	Unlikely	\$17,200	\$7,000	Unlikely	206	n/a	\$23,000	\$270,600
Area 7: Aqua Fria River Area	Little Sycamore Creek	\$0	\$0	\$5,100	\$44,000	n/a	n/a	Unlikely	\$5,400	\$2,500	Unlikely	0	n/a	\$0	\$0
	Sycamore Creek	\$0	\$0	\$0	\$0	n/a	n/a	Unlikely	\$1,000	\$1,000	Unlikely	0	n/a	\$0	\$0
	Indian Creek	\$0	\$0	\$16,700	\$138,700	n/a	n/a	Unlikely	\$1,000	\$1,000	Unlikely	0	n/a	\$0	\$0
	Silver Creek	\$0	\$0	\$15,600	\$142,500	n/a	n/a	Unlikely	\$4,000	\$4,000	Unlikely	0	n/a	\$0	\$0
	Larry Creek	\$0	\$0	\$7,500	\$61,100	n/a	n/a	Unlikely	\$500	\$500	Unlikely	0	n/a	\$0	\$0
	Lousy Canyon	\$0	\$0	\$6,900	\$55,200	n/a	n/a	Unlikely	\$500	\$500	Unlikely	0	n/a	\$0	\$0
Total	\$0	\$0	\$51,800	\$441,500	\$0	\$0	Unlikely	\$12,400	\$9,500	Unlikely	0	n/a	\$0	\$0	
Grand Total		\$4,983,000	\$8,845,900	\$335,400	\$2,814,200	\$502,400	\$4,306,100	Unlikely	\$110,300	\$60,300	Unlikely	362	Uncertain	\$64,000	\$548,100
Annualized Costs (Low)			\$411,400												
Annualized Costs (High)			\$1,155,000												

Exhibit ES-5
SUMMARY OF FUTURE COSTS OF CONSERVATION ACTIVITIES FOR THE GILA CHUB
(2005-2024, Discounted at 7 percent)

UNIT	STREAM REACH	Water Management		Livestock Grazing		Tribes		Development	Species Management		Recreation	Fire Management	Mining	Transportation	
		Low	High	Low	High	Low	High	(likelihood)	Low	High	(acres)		Low	High	
Area 1: Upper Gila River	Turkey Creek (NM)	\$0	\$0	\$0	\$0	n/a	n/a	Unlikely	\$1,000	\$0	Modest	0	n/a	\$0	\$0
	Dix Creek	\$0	\$0	\$6,100	\$47,000	n/a	n/a	Unlikely	\$1,000	\$0	n/a	0	n/a	\$0	\$0
	Harden Cienega Creek (AZ/NM)	\$0	\$0	\$18,000	\$165,600	n/a	n/a	Unlikely	\$1,000	\$0	n/a	0	n/a	\$0	\$0
	Eagle Creek	\$0	\$0	\$7,200	\$57,600	n/a	n/a	Unlikely	\$5,400	\$0	n/a	0	n/a	\$0	\$0
	East Eagle Creek	\$0	\$0	\$32,700	\$297,900	n/a	n/a	Unlikely	\$1,000	\$0	n/a	0	n/a	\$0	\$0
	Total	\$0	\$0	\$64,000	\$568,100	\$0	\$0	Unlikely	\$9,400	\$0	Modest	0	n/a	\$0	\$0
Area 2: Middle Gila River	Mineral Creek	\$0	\$0	\$20,800	\$187,600	n/a	n/a	Unlikely	\$5,400	\$0	n/a	0	Uncertain	\$0	\$0
	Blue River	\$0	\$0	n/a	n/a	\$318,100	\$2,351,500	Unlikely	\$6,900	\$0	n/a	0	n/a	\$0	\$0
	Bonita Creek	\$667,000	\$2,470,000	\$10,800	\$94,100	\$75,000	\$1,051,700	Unlikely	\$6,900	\$0	Unlikely	5	n/a	\$0	\$0
	Total	\$667,000	\$2,470,000	\$31,600	\$281,700	\$393,100	\$3,403,200	Unlikely	\$19,200	\$0	Unlikely	5	n/a	\$0	\$0
Area 3: Babocomari River Area	O'Donnell Canyon	\$0	\$0	\$1,200	\$27,400	n/a	n/a	Unlikely	\$5,400	\$0	n/a	0	n/a	\$5,800	\$39,500
	Turkey Creek	\$0	\$0	\$0	\$0	n/a	n/a	Unlikely	\$5,400	\$0	n/a	0	n/a	\$5,800	\$39,500
	Post Canyon Creek	\$0	\$0	\$0	\$0	n/a	n/a	Unlikely	\$8,700	\$0	n/a	0	n/a	\$0	\$0
	Total	\$0	\$0	\$1,200	\$27,400	\$0	\$0	Unlikely	\$19,500	\$0	n/a	0	n/a	\$11,700	\$79,000
Area 4: Lower San Pedro River Area	Bass Canyon	\$0	\$0	\$3,000	\$4,700	n/a	n/a	Unlikely	\$5,400	\$0	n/a	0	n/a	\$0	\$0
	Hot Springs Canyon	\$0	\$0	\$3,000	\$4,700	n/a	n/a	Unlikely	\$5,400	\$0	Unlikely	0	n/a	\$0	\$0
	Redfield Canyon	\$0	\$0	\$9,600	\$56,400	n/a	n/a	Unlikely	\$5,400	\$0	n/a	0	n/a	\$0	\$0
	Total	\$0	\$0	\$15,600	\$65,800	\$0	\$0	Unlikely	\$16,200	\$0	Unlikely	0	n/a	\$0	\$0
Area 5: Lower Santa Cruz River Area	Cienega Creek	\$1,658,700	\$1,658,700	\$23,800	\$208,800	n/a	n/a	Unlikely	\$5,400	\$0	n/a	150	n/a	\$17,500	\$118,500
	Mattie Canyon	\$0	\$0	\$9,100	\$76,800	n/a	n/a	Unlikely	\$5,400	\$0	n/a	0	n/a	\$0	\$0
	Empire Gulch	\$0	\$0	\$10,300	\$88,900	n/a	n/a	Unlikely	\$5,400	\$0	n/a	0	n/a	\$0	\$0
	Sabino Canyon	\$0	\$0	\$14,200	\$127,300	n/a	n/a	Unlikely	\$1,000	\$0	Uncertain	1	n/a	\$0	\$0
	Total	\$1,658,700	\$1,658,700	\$57,400	\$501,800	\$0	\$0	Unlikely	\$17,200	\$0	Uncertain	151	n/a	\$17,500	\$118,500
Area 6: Upper Verde River Area	Walker Creek	\$0	\$0	\$12,000	\$78,300	n/a	n/a	Unlikely	\$5,400	\$0	Unlikely	0	n/a	\$5,300	\$76,600
	Red Tank Draw	\$0	\$0	\$15,400	\$133,300	n/a	n/a	Unlikely	\$1,000	\$0	Unlikely	0	n/a	\$5,300	\$76,600
	Spring Creek	\$0	\$0	\$4,900	\$33,400	n/a	n/a	Unlikely	\$5,400	\$0	Unlikely	206	n/a	\$5,800	\$39,500
	Williamson Valley Wash	\$0	\$0	\$0	\$0	n/a	n/a	Unlikely	\$5,400	\$0	n/a	0	n/a	\$0	\$0
	Total	\$0	\$0	\$32,300	\$245,000	\$0	\$0	Unlikely	\$17,200	\$0	Unlikely	206	n/a	\$16,400	\$192,700
Area 7: Aqua Fria River Area	Little Sycamore Creek	\$0	\$0	\$3,600	\$31,400	n/a	n/a	Unlikely	\$5,400	\$0	Unlikely	0	n/a	\$0	\$0
	Sycamore Creek	\$0	\$0	\$0	\$0	n/a	n/a	Unlikely	\$1,000	\$0	Unlikely	0	n/a	\$0	\$0
	Indian Creek	\$0	\$0	\$11,900	\$98,700	n/a	n/a	Unlikely	\$1,000	\$0	Unlikely	0	n/a	\$0	\$0
	Silver Creek	\$0	\$0	\$11,100	\$101,500	n/a	n/a	Unlikely	\$4,000	\$0	Unlikely	0	n/a	\$0	\$0
	Larry Creek	\$0	\$0	\$5,300	\$43,500	n/a	n/a	Unlikely	\$500	\$0	Unlikely	0	n/a	\$0	\$0
	Lousy Canyon	\$0	\$0	\$4,900	\$39,300	n/a	n/a	Unlikely	\$500	\$0	Unlikely	0	n/a	\$0	\$0
	Total	\$0	\$0	\$36,800	\$314,400	\$0	\$0	Unlikely	\$12,400	\$0	Unlikely	0	n/a	\$0	\$0
Grand Total		\$2,325,700	\$4,128,700	\$238,900	\$2,004,200	\$393,100	\$3,403,200	Unlikely	\$111,100	\$0	Modest	362	Uncertain	\$45,600	\$390,300
Annualized Costs (Low)		\$809,200													
Annualized Costs (Low)		\$1,905,600													

8. The purpose of this report is to estimate the economic impact of actions taken to protect the federally-listed Gila chub (*Gila intermedia*) and its 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 Gila chub was proposed to be listed, and it attempts to predict future costs likely to occur after the 2005 proposed CHD is finalized.
9. 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 U.S. Fish and Wildlife Service (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
10. This section describes the framework for this 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 activities and economic impacts. Then, it presents the analytic time frame used in the report. Finally, this section lists the information sources relied upon in this analysis.

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

11. This economic analysis considers both the economic efficiency and distributional effects that may result from efforts to protect the Gila chub and its habitat (hereinafter referred to collectively as “Gila chub 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 Gila chub conservation efforts.
12. 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 Gila chub 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.
13. For each land use activity, this analysis presents economic impacts incurred in different time periods in present value terms. The text box entitled "Calculating Present Value and Annualized Impacts" describes the methods used. Differences 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

14. 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 Gila chub 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
15. In some instances, compliance costs may provide a reasonable approximation for the efficiency effects associated with a regulatory action. For example, a Federal landowner or manager may enter into a consultation with the Service to ensure that a

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>.

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 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.

16. 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.
17. This analysis begins by measuring costs associated with measures taken to protect Gila chub and its 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.

Calculating Present Value and Annualized Impacts

For each land use activity, this analysis presents economic impacts incurred in different time periods in present value terms. Present value terms are used to compare economic costs incurred in different time periods. The present value represents the value of a payment or stream of payments to be made in the future in common dollar terms. The discount rate used defines how rapidly the value today of a future real dollar declines through time. In the context of CHD activities involving future costs, translation of these future economic costs to present value terms requires the following: a) projected future costs of Gila chub conservation activities (the undiscounted costs); and b) the specific years in which these impacts are expected to be incurred. With these data, the present value of the future stream of impacts (PV_c) of Gila chub conservation activities from year t to T is measured in 2005 dollars according to the following standard formula^a:

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

C_t = forecast cost of Gila chub conservation activities in year t

r = discount rate^b

Impacts of conservation activities for each activity in each stream reach 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, 2005 through 2024. Annualized impacts of future Gila chub 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 2002 and T is 2004; to derive the present value of future conservation activities, t is 2005 and T is 2024.

^b To discount and annualize costs, guidance provided by the OMB specifies the use of a real rate of seven percent and three percent. (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)

1.1.2 Distributional and Regional Economic Effects

18. 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

19. This analysis considers how small entities, including small businesses, organizations, and governments, as defined by the Regulatory Flexibility Act, might be affected by future Gila chub 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

Regional Economic Effects

20. 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.
21. 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

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.

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.

22. 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**

23. 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}
24. 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.

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)).

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.

1.2.1 Sections of the Act Relevant to the Analysis

25. 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 In addition, under section 4 the Service is required to develop a recovery plan that recommends actions necessary to satisfy the biological needs and assure the recovery of the species. The plan serves as guidance for interested parties, including Federal, State, and local agencies, private landowners, and the general public.
26. 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, 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 (i.e., 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

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.

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/>.

mitigated. 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

27. 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

28. 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

29. 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).

Stigma Impacts

30. 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.

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.

1.2.4 Benefits

31. 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
32. In the context of CHD, the primary purpose of the rulemaking (i.e., the direct benefit) is the potential to enhance conservation of the species. The published economics literature has documented that social welfare benefits can result from the conservation and recovery of endangered and threatened species. In its guidance for implementing Executive Order 12866, OMB acknowledges that it may not be feasible to monetize, or even quantify, the benefits of environmental regulations due to either an absence of defensible, relevant studies or a lack of resources on the implementing agency's part to conduct new research.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.*
33. 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.
34. 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 decreased off-road vehicle use to improve species habitat leads to an increase in opportunities for other recreational activities within the region, the local economy may experience an associated measurable, positive impact. Where data are available, this analysis attempts to capture the *net* economic impact (i.e., the increased regulatory burden less any discernable offsetting market gains), of species conservation activities imposed on regulated entities and the regional economy.

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 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>.

1.2.5 Geographic Scope of the Analysis

35. The geographic scope of the analysis includes areas proposed for CHD. The economic impacts of potential designation are estimated for each area. The analysis focuses on activities within or affecting these areas.

1.3 Analytic Time Frame

36. 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 2002 (year of the species' proposed listing) to 2024 (twenty years from the present). Forecasts of economic conditions and other factors beyond the next 20 years would be speculative.³¹

1.4 Information Sources

37. The primary sources of information for this report were communications with and data provided by personnel from the Service, Federal action agencies, affected Tribes, 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, including U.S. Forest Service (USFS);
- U.S. Bureau of Land Management (BLM);
- U.S. Bureau of Reclamation (USBR);
- Bureau of Indian Affairs (BIA);
- U.S. Fish and Wildlife Service (Service);
- The Natural Resource Conservation Service (NRCS);
- Fort Huachuca;
- State agencies, including departments of water resources, agriculture, energy, game and fish, natural resources, recreation, and transportation;
- Various County and City governments;

³¹ Note that the 20-year time horizon is used where better information is lacking. Where information exists for estimating costs to 50 years, those estimates are included.

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

38. 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 full list of information sources.

1.5 Structure of Report

39. The remainder of this report is organized as follows:

- Section 2: Background And Socioeconomic Overview
- Section 3: Past Economic Impacts
- Section 4: Water Management And Use
- Section 5: Livestock Grazing
- Section 6: Potential Economic Impacts to San Carlos Apache Tribal Activities
- Section 7: Potential Economic Impacts to Residential And Related Development
- Section 8: Potential Impacts on Other Activities
- Appendix A: Administrative Costs
- Appendix B: Small Business Impacts and Energy Impacts
- References

Sections 3 through 8 are organized by affected activity. For each of these activities, the analysis discusses impacts by proposed CHD area and stream reach.

40. This section provides information on the history of the Gila chub listing and CHD and describes the socioeconomic characteristics of proposed CHD areas.³² The proposed CHD for the Gila chub traces the path of 212 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

41. The Gila chub is a small-finned, deep-bodied, chubby, and darkly colored member of the minnow family. The proposed CHD rule describes the species in detail. The Service has proposed to designate critical habitat for the Gila chub on approximately 212 miles of stream in Arizona and New Mexico (please refer to the Federal register notice for legal descriptions of proposed units). The critical habitat includes the area of bankfull width of designated river segments plus 300 feet on either side of the banks.³³ The proposed CHD is subdivided into seven areas and 30 stream reaches. Exhibit 2-1 presents a map of the proposed CHD for the Gila chub.
42. 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. To estimate land ownership, geographic data of current land ownership was overlaid with CHD polygons using GIS analysis.³⁴ These estimates of land ownership by stream reach are presented in Exhibit 2-2.
43. As presented in Exhibit 2-2, of the 15,453 acres estimated to comprise the area of proposed CHD for the Gila chub, approximately 59 percent are Federal lands (owned by BLM or USFS), and another 22 percent are privately owned. Of the remaining, 5 percent are State lands and 14 percent are Tribal lands.

³² A detailed discussion of potentially affected Tribal economies is presented in Section 8.

³³ The bankfull width of the stream is defined by the Service as the width of the stream or river at bankfull discharge, i.e., the flow at which water begins to leave the channel and move into the floodplain.

³⁴ Note that this analysis present only approximate estimates of land acreage included in critical habitat areas. Please refer to the proposed rule for legal descriptions of proposed CHD.

Exhibit 2-1

MAP OF PROPOSED CHD FOR THE GILA CHUB

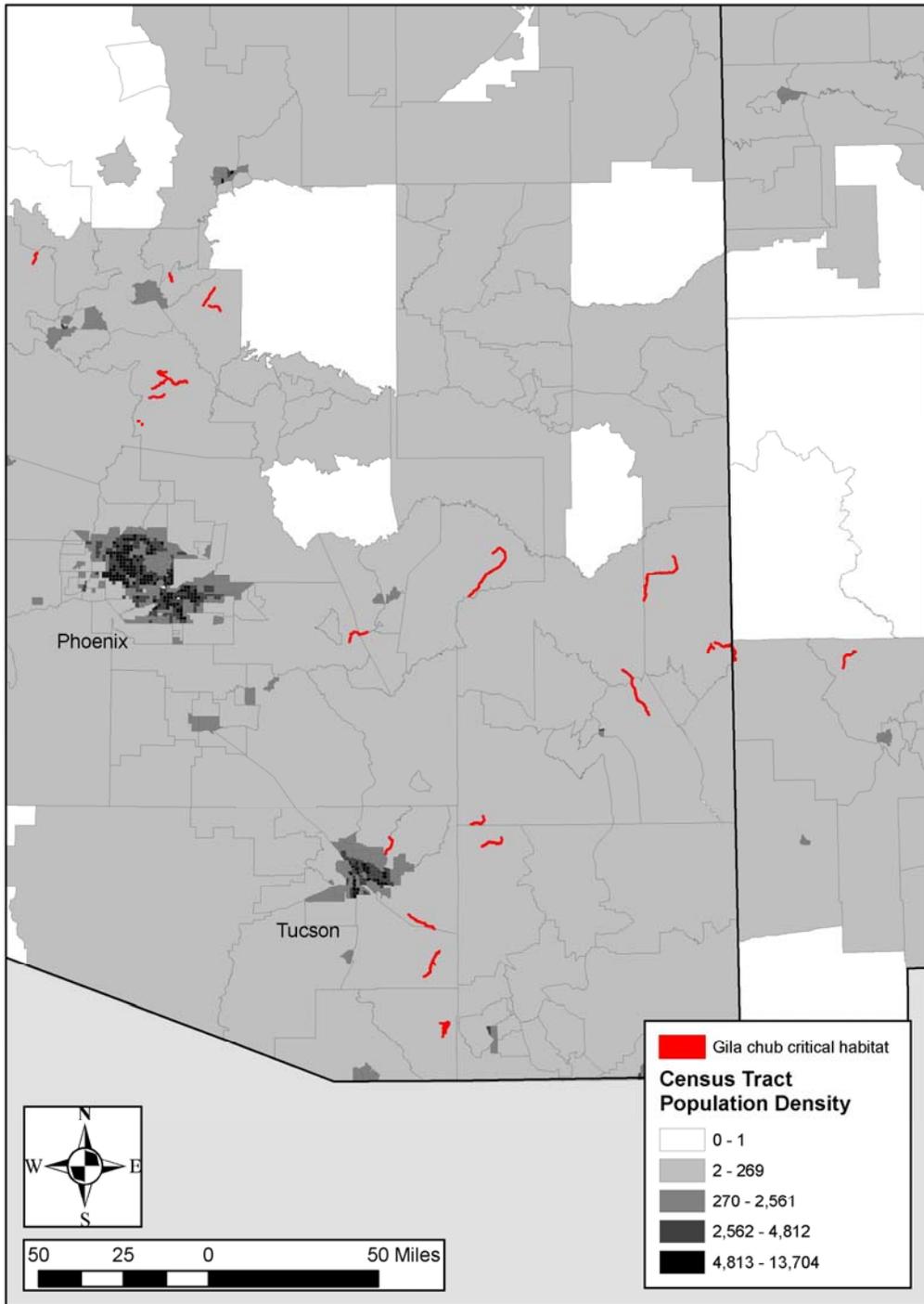


Exhibit 2-2

OWNERSHIP CLASSIFICATION OF GILA CHUB CHD AREAS (estimated Acres)

Area/Sub-Unit		BLM	Forest Service	Tribal Lands	Private	State	Total
1 Upper Gila River	Dix Creek	0	354	0	0	0	354
	Eagle Creek	0	350	7	400	0	757
	East Eagle Creek	0	1,018	0	0	0	1,018
	Harden Cienega Creek	0	863	0	169	0	1,031
	Turkey Creek (NM)	0	583	0	0	0	583
2 Middle Gila River	Blue River	0	0	1,830	39	0	1,870
	Bonita Creek	1,080	0	300	0	0	1,380
	Mineral Creek	0	130	0	136	386	652
3 Babocomari River Area	Turkey Creek (BRU)	4	108	0	176	0	288
	O'Donnell Canyon	120	42	0	291	0	453
	Post Canyon	32	71	0	108	0	212
4 Lower San Pedro River Area	Bass Canyon	88	0	0	167	0	255
	Hot Springs Canyon	405	0	0	40	21	466
	Redfield Canyon	65	0	0	227	230	521
5 Lower Santa Cruz River Area	Cienega Creek	599	0	0	738	52	1,389
	Empire Gulch	160	0	0	0	80	240
	Mattie Canyon	174	0	0	0	3	178
	Sabino Canyon	0	501	0	3	0	505
6 Upper Verde River Area	Red Tank Draw	0	433	0	70	0	503
	Spring Creek	0	67	0	141	56	264
	Walker Creek	0	272	0	74	0	346
	Williamson Valley Wash	0	0	0	328	0	328
7 Aqua Fria River Area	Indian Creek	117	244	0	23	0	385
	Larry Creek	37	0	0	0	0	37
	Little Sycamore Creek	0	88	0	128	0	216
	Lousy Canyon	33	0	0	0	0	33
	Silver Creek	181	208	0	0	0	389
	Sycamore Creek	0	653	0	179	0	831
Grand Total		3,095	5,987	2,138	3,436	828	15,483
<i>% of Total Area</i>		20%	39%	14%	22%	5%	100%

Source: "Arizona Landuse Summary" GIS data. Gila chub CHD GIS data buffered by 300 feet, Service, 2005.

2.2 Threats to the Species and its Habitat

44. The proposed rule states that, in addition to historic losses, several current human land use activities pose threats to the Gila chub. These are:

- Groundwater pumping, surface water diversions, impoundments, and channelization
- Livestock grazing
- Fire management
- Agriculture (primarily agricultural water use)
- Mining (sand and gravel as well as mineral)

- Road building
- Non-native species introductions
- Urbanization (residential and commercial development)
- Recreation (fishing and off-road vehicle use)

2.3 **Socioeconomic Profile of the Critical Habitat Area**

45. This section summarizes key economic and demographic information for the counties containing proposed CHD for the Gila chub, 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 Gila chub, these data provide context for the broader analysis.

46. Exhibit 2-3 presents a summary of the county in which each of the streams proposed for Gila chub critical habitat is located.

Exhibit 2-3		
GILA CHUB CRITICAL HABITAT SEGMENTS BY COUNTY IN ARIZONA AND NEW MEXICO		
Area	County	Creeks/Canyons/Rivers
1	Grant, Greenlee	Turkey Creek, Dix Creek, Harden Cienega Creek, Eagle Creek, East Eagle Creek
2	Gila, Graham, Pinal	Mineral Creek, Blue River, Bonita Creek
3	Santa Cruz	O'Donnell Canyon, Turkey Creek, Post Canyon Creek
4	Cochise, Graham	Bass Canyon, Hot Springs Canyon, Redfield Canyon
5	Pima	Cienega Creek, Mattie Canyon, Empire Gulch, Sabino Canyon
6	Yavapai	Walker Creek, Red Tank Draw, Spring Creek, Williamson Valley Wash
7	Yavapai	Little Sycamore Creek, Sycamore Creek, Indian Creek, Silver Creek, Larry Creek, Lousy Canyon

2.3.1 Population Characteristics

47. The proposed CHD spans an array of urban and rural areas within Arizona and one county in 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.

48. In Arizona, all counties containing CHD have a lower per capita income than Arizona's average of approximately \$20,000. Six out of the eight counties have higher poverty rates than the State average of about 14 percent. Santa Cruz County has the highest poverty rate of these counties with almost 25 percent of all residents living below the poverty threshold. The counties containing CHD in Arizona account for about 29 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.
49. Within New Mexico, only Grant County contains CHD, and it represents only about 1.7 percent of the State's population. Grant County has a per capital income of about \$14,600, which is almost \$3,000 below the state average of \$17,261, and a poverty rate slightly higher than the state average at 18.7 percent.
50. Of the nine counties containing proposed critical habitat, all have a lower per capita income and eight 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 income per capita than their state averages.

Exhibit 2-4							
SOCIOECONOMIC PROFILE OF COUNTIES CONTAINING CRITICAL HABITAT FOR THE GILA CHUB							
State	County	Population 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%	\$20,275	13.9%
	Cochise	18.9	117,755	2.3%	20.6%	\$15,988	17.7%
	Gila	10.7	51,335	1.0%	27.6%	\$16,315	17.4%
	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%
	Pima	91.9	843,746	16.4%	26.5%	\$19,785	14.7%
	Pinal	33.4	179,727	3.5%	54.5%	\$16,025	16.9%
	Santa Cruz	31.0	38,381	1.8%	29.3%	\$13,278	24.5%
	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%
	Grant	7.8	31,002	1.7%	12%	\$14,597	18.7%

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

2.3.2 Economic Activity

51. 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 2-5 highlights the annual payroll for various industries in the nine counties

containing proposed CHD for the Gila chub. The principal industries, in terms of annual payroll, include services, retail trade, manufacturing and construction.³⁵

52. Exhibit 2-6 provides industry and employment data for all counties that contain proposed CHD for the Gila chub. 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 2002. About 32,000 business establishments operate and employ about 430,000 individuals in the counties containing proposed CHD for the Gila chub. These figures provide a measure of the average density of commercial and industrial establishments in the region.
53. The largest employment sectors within the counties containing CHD are services, retail trade, and manufacturing. Employment within the services sector represented approximately 51 percent of the job base while employment within the retail trade constituted 16.5 percent of all jobs in the counties. Manufacturing employment accounted for nearly 9.3 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.
54. 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 Cochise, Gila, Graham, Pima Pinal, Yavapai and Grant counties. In most of these counties, retail trade is the second most prevalent industry. In Greenlee county, retail trade is the only recorded industry, as others are too sparse for the Census to report. In the fast-growing counties of Pima and Yavapai, manufacturing and construction are large industries.

³⁵ 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).

Exhibit 2-5

**ECONOMIC ACTIVITY WITHIN COUNTIES CONTAINING GILA CHUB CRITICAL HABITAT
ANNUAL PAYROLL BY INDUSTRY
(\$ Thousands (2002))**

Industry	Arizona										New Mexico	
	Cochise	Gila	Graham	Greenlee	Pima	Pinal	Santa Cruz	Yavapai	Eight County Total	% of total state*	Grant	% of total state*
Agriculture, Forestry, Hunting, and Fishing	0	0	0	n/a	3,882	2,980	981	0	597,987	18.6%	0	0.0%
Mining	2,071	0	0	0	39,501	7,806	0	32,204	81,582	24.3%	0	0.0%
Utilities	30,908	4,920	0	0	103,127	14,911	0	15,193	169,059	25.6%	0	0.0%
Construction	39,395	21,783	5,367	0	741,519	37,474	10,495	153,399	1,009,432	18.2%	19,712	1.5%
Manufacturing	13,851	0	5,974	0	1,419,187	97,614	14,802	105,807	1,657,235	23.7%	12,210	1.0%
Wholesale Trade	12,083	10,801	5,522	0	263,619	20,972	57,213	47,867	418,077	11.7%	2,663	0.4%
Retail Trade	109,278	45,189	24,960	2,093	1,002,171	113,756	43,311	199,456	1,540,214	23.1%	20,026	1.0%
Transportation/ Warehousing	8,539	6,121	1,378	0	165,093	9,995	19,185	15,096	225,407	8.5%	1,425	0.4%
Information ^a	15,342	3,837	2,192	0	456,301	8,953	2,045	21,511	510,181	19.9%	5,577	1.1%
Finance and Insurance	14,636	6,642	2,857	0	359,879	31,317	5,515	41,973	462,819	10.0%	5,276	0.6%
Real Estate	12,684	3,267	1,500	0	168,767	12,301	3,877	32,561	234,957	18.0%	1,720	0.7%
Auxiliaries	1,347	0	0	n/a	94,145	2,896	6,163	1,560	106,111	14.9%	n/a	n/a
Unclassified ^b	0	99	0	n/a	6,799	332	0	0	7,230	41.8%	0	0.0%
Services and Other Industries	323,731	115,382	40,087	0	3,848,049	306,225	53,213	496,201	5,182,888	20.4%	68,081	1.0%

Source: U.S. Census Bureau, 2002 County Business Patterns, accessed at <http://censtats.census.gov/cbpnaic/cbpnaic.shtml>.

^a Information sector includes media services, such as newspaper and book publishers, cable networks, and telecommunication services.

^b Establishments unclassified by NAICs code.

* Percent of total state payroll in each industry classification

Exhibit 2-6
ECONOMIC ACTIVITY WITHIN COUNTIES CONTAINING GILA CHUB CHD
NUMBER OF ESTABLISHMENTS AND EMPLOYEES BY INDUSTRY (2002)

Industry	State	Arizona										New Mexico*	
	County	Cochise	Gila	Graham	Greenlee	Pima	Pinal	Santa Cruz	Yavapai	Eight County Total	% of State	Grant	% of State
Agriculture, Forestry, Hunting, and Fishing	Employees	20-99	100-249	20-90	n/a	157	142	50	0-19	806	43.9%	0-19	4.1%
	Establishments	7	8	5	n/a	22	16	7	9	74	31.0%	1	1.0%
Mining	Employees	64	500-999	20-99	1,000-2,499	1,049	260	0-19	992	5,981	72.7%	250-499	3.6%
	Establishments	8	8	2	2	25	17	1	19	82	43.4%	5	0.8%
Utilities	Employees	539	96	20-99	20-99	1,779	269	20-99	276	3,256	31.2%	20-99	2.0%
	Establishments	24	7	4	4	25	20	7	25	116	42.0%	7	3.2%
Construction	Employees	1,635	948	236	20-99	23,760	1,562	514	5,753	34,507	20.8%	678	1.6%
	Establishments	232	183	46	9	1,929	250	88	981	3,718	28.4%	86	1.8%
Manufacturing	Employees	574	1,000-2,499	259	0-19	29,755	2,972	640	3,323	40,041	23.9%	295	0.9%
	Establishments	42	22	15	1	730	90	41	193	1,134	23.6%	14	0.9%
Wholesale Trade	Employees	493	362	221	20-99	7,634	621	1,980	1,653	13,063	15.4%	139	0.7%
	Establishments	68	30	18	7	844	90	195	185	1,437	21.7%	24	1.1%
Retail Trade	Employees	5,775	2,219	1,365	135	44,045	5,960	2,309	9,171	70,979	25.4%	1,139	1.3%
	Establishments	438	180	101	21	2,825	418	221	796	5,000	28.7%	120	1.6%
Transportation/Warehousing	Employees	357	236	53	20-99	5,188	422	790	697	7,842	9.7%	124	1.0%
	Establishments	64	21	20	5	373	71	105	112	771	28.6%	18	1.6%
Information	Employees	551	178	112	20-99	6,983	317	85	761	9,086	16.7%	187	1.2%
	Establishments	48	24	12	5	331	35	12	79	546	25.2%	18	2.2%
Finance and Insurance	Employees	568	220	95	0-19	9,054	727	247	1,269	12,199	11.2%	208	0.9%
	Establishments	106	47	22	4	1,160	101	41	279	1,760	22.0%	43	1.6%
Real Estate	Employees	625	154	86	0-19	6,639	654	196	1,488	9,861	22.2%	103	1.0%
	Establishments	123	53	20	2	1,121	138	56	320	1,833	27.2%	38	1.8%
Auxiliaries	Employees	59	20-99	0-19	n/a	2,942	74	194	83	3,470	19.2%	0	0.0%
	Establishments	8	3	2	n/a	33	4	8	5	63	24.8%	0	0.0%

Exhibit 2-6 (continued)

**ECONOMIC ACTIVITY WITHIN COUNTIES CONTAINING GILA CHUB CHD
NUMBER OF ESTABLISHMENTS AND EMPLOYEES BY INDUSTRY (2002)**

Industry	State	Arizona										New Mexico*	
	County	Cochise	Gila	Graham	Greenlee	Pima	Pinal	Santa Cruz	Yavapai	Eight County Total	% of State	Grant	% of State
Unclassified	Employees	0-19	0	0-19	n/a	137	8	0-19	0-19	221	51.8%	0-19	8.0%
	Establishments	12	4	2	n/a	95	13	11	24	161	29.2%	4	2.2%
Services and Other Industries	Employees	14,457	5,582	2,671	593	153,991	14,516	3,003	23,829	218,642	23.8%	3,823	1.4%
	Establishments	1,100	557	228	33	9,634	984	310	2,355	15,201	26.8%	318	1.6%

Source: U.S. Census Bureau, 2002 County Business Patterns, accessed at <http://censtats.census.gov/cbpnaic/cbpnaic.shtml>

Note: Totals and percentages were calculated using the maximum number when ranges were reported.

55. This section provides a summary of the economic impacts associated with Gila chub conservation activities since the time of the proposed listing. This section presents the past costs associated with conference opinions, Gila chub specific management, and non-native species management from 2002 to present. First this section presents a summary of past costs of Gila chub conservation efforts. The second section estimates the administrative and project modification costs of Gila chub conference opinions. The third section estimates the costs of Gila chub specific management activities. The last section discusses non-native species management efforts.

3.1 Summary of Past Economic Impacts

56. This analysis estimates the past costs of conference opinion, Gila chub specific management, and non-native species management activities. The total costs of past Gila chub conservation efforts in CHD areas since proposed listing are estimated to range from \$282,000 to \$345,000 (undiscounted dollars). Exhibit 3-1 presents a summary of the past economic impacts by proposed CHD area and stream reach. Note, some proposed CHD stream reaches have not had any Gila chub conservation activities conducted within them from 2002 to present.

Exhibit 3-1

SUMMARY OF PAST COSTS RELATED TO GILA CHUB CONSERVATION ACTIVITIES (SINCE 2002)

Area	Stream Reach	Undiscounted Value		Present Value 3%		Present Value 7%	
		Low	High	Low	High	Low	High
Area 1 Upper Gila River	Turkey Creek	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000
	Dix Creek	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000
	Harden Cienega Creek	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000
	Eagle Creek	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000
	East Eagle Creek	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000
	Subtotal	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000
Area 2 Middle Gila River	Mineral Creek	\$2,000	\$4,000	\$2,000	\$4,000	\$3,000	\$4,000
	Blue River	\$0	\$0	\$0	\$0	\$0	\$0
	Bonita Creek	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000
	Subtotal	\$3,000	\$5,000	\$3,000	\$5,000	\$4,000	\$5,000
Area 3 Babocomari River Area	O'Donnell Canyon	\$82,000	\$88,000	\$89,000	\$95,000	\$99,000	\$105,000
	Turkey Creek	\$2,000	\$4,000	\$2,000	\$4,000	\$3,000	\$4,000
	Post Canyon Creek	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000
	Subtotal	\$86,000	\$94,000	\$93,000	\$101,000	\$104,000	\$111,000
Area 4 Lower San Pedro River	Bass Canyon	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000
	Hot Springs Canyon	\$9,000	\$13,000	\$9,000	\$14,000	\$9,000	\$14,000
	Redfield Canyon	\$12,000	\$16,000	\$12,000	\$17,000	\$12,000	\$17,000
	Subtotal	\$22,000	\$30,000	\$22,000	\$32,000	\$22,000	\$32,000
Area 5 Lower Santa Cruz River	Cienega Creek	\$22,000	\$34,000	\$23,000	\$35,000	\$24,000	\$36,000
	Mattie Canyon	\$8,000	\$12,000	\$9,000	\$13,000	\$10,000	\$14,000
	Empire Gulch	\$8,000	\$12,000	\$9,000	\$13,000	\$10,000	\$14,000
	Sabino Canyon	\$87,000	\$94,000	\$90,000	\$98,000	\$95,000	\$104,000
	Subtotal	\$125,000	\$152,000	\$131,000	\$159,000	\$139,000	\$168,000
Area 6 Upper Verde River	Walker Creek	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000
	Red Tank Draw	\$2,000	\$4,000	\$2,000	\$4,000	\$3,000	\$4,000
	Spring Creek	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000
	Williamson Valley Wash	\$0	\$0	\$0	\$0	\$0	\$0
	Subtotal	\$6,000	\$8,000	\$6,000	\$8,000	\$7,000	\$8,000
Area 7 Aqua Fria River	Little Sycamore Creek	\$2,000	\$4,000	\$2,000	\$4,000	\$3,000	\$4,000
	Sycamore Creek	\$2,000	\$4,000	\$2,000	\$4,000	\$3,000	\$4,000
	Indian Creek	\$6,000	\$9,000	\$6,000	\$9,000	\$6,000	\$10,000
	Silver Creek	\$6,000	\$9,000	\$6,000	\$9,000	\$6,000	\$10,000
	Larry Creek	\$7,000	\$10,000	\$8,000	\$10,000	\$8,000	\$11,000
	Lousy Canyon	\$7,000	\$10,000	\$8,000	\$10,000	\$8,000	\$11,000
	Subtotal	\$30,000	\$46,000	\$32,000	\$46,000	\$34,000	\$50,000
Total		\$282,000	\$345,000	\$297,000	\$361,000	\$320,000	\$384,000

Note: Totals may not sum due to rounding.

3.2 Costs Associated with Conference Opinions

57. There have been eight formal conference opinions on the Gila chub since 2002. As Exhibit 3-2 shows five of these conference opinions were conducted for activities within proposed CHD.

Exhibit 3-2						
PAST CONFERENCE OPINIONS ON THE GILA CHUB (SINCE 2002)						
Action	Year	Agency	Stream Reach	County	State	Activity
Formal conference on the Las Cienegas Bank Stabilization Project	2005	BLM	Area 5: Lower Santa Cruz River (Cienega Creek)	Pima	AZ	Bank Stabilization
Programmatic Biological and Conference Opinion The Continued Implementation of the Land and Resource Management Plans for the Eleven National Forests and National Grasslands of the Southwestern Region	2005	USFS	Area 1: Upper Gila River (Dix Creek, Eagle Creek, East Eagle Creek, and Harden Cienega Creek) Area 2: Middle Gila River (Mineral Creek) Area 3: Babocomari River (Turkey Creek, O'Donnell Canyon, and Post Canyon) Area 5: Lower Santa Cruz River (Sabino Canyon) Area 6: Upper Verde River (Red Tank Draw, Spring Creek, Walker Creek) Area 7: Agua Fria River (Indian Creek, Little Sycamore Creek, Silver Creek, and Sycamore Creek)	All	AZ	Federal Lands Management
Formal Consultation and Formal Conference for the Proposed Reestablishment of Spikedace, Loach Minnow, Gila Topminnow, Desert Pupfish, and Augmentation of Gila Chub into Multiple Springs and Stream within the Muleshoe Cooperative Management Area	2005	BLM	Area 4: Lower San Pedro River (Hot Springs Canyon and Redfield Canyon)	Cochise	AZ	Fish restocking
Formal Conference on the Existing Phoenix Resource Management Plan for Agua Fria National Monument	2004	BLM	Area 7: Agua Fria River (Indian Creek, Silver Creek, Lousy Canyon, and Larry Creek)	Yavapai	AZ	Management plan for grazing, transportation, fire management, and recreation
Re-initiation of Conference on the Gila Box Riparian National Conservation Area Interdisciplinary Activity Plan	2004	BLM	Outside of CHD	Graham	AZ	Federal lands management

Exhibit 3-2						
PAST CONFERENCE OPINIONS ON THE GILA CHUB (SINCE 2002)						
Action	Year	Agency	Stream Reach	County	State	Activity
Statewide Land Use Plan Amendment for Fire, Fuels, and Air Quality Management	2004	BLM	Area 2: Middle Gila River (Bonita Creek and Mineral Creek) Area 3: Babocomari River (O'Donnell Creek and Turkey Creek) Area 4: Lower San Pedro River (Bass Canyon, Hot Springs Canyon, and Redfield Canyon) Area 5: Santa Cruz River (Cienega Creek, Empire Gulch, and Mattie Canyon) Area 6: Verde River (Red Tank Draw) Area 7: Agua Fria (Indian Creek, Larry Creek, Little Sycamore creek, Lousy Canyon, Silver Creek, Sycamore Creek)	All	AZ	Fire management
Martinez Canyon Native Fish Restoration	2004	BLM	Outside of CHD	Pinal	AZ	Fish restocking
New Bull Gap Road Section Project, Gila Box Riparian National Conservation Area	2003	BLM	Outside of CHD	Graham	AZ	Transportation
Proposed Las Ciengas National Conservation Area Resource Management Plan	2002	BLM	Area 5: Lower Santa Cruz River (Cienega Creek, Empire Gulch, and Mattie Canyon)	Pima & Santa Cruz	AZ	Management plan for wildlife management, grazing, recreation, and utility corridors
Continuation of Livestock Grazing on the Coronado National Forest (Re-initiation of 1999 Biological Opinion)	2002	USFS	Area 5: Lower Santa Cruz River (Sabino Canyon and O'Donnell Creek)	Cochise, Santa Cruz, Pima, Pinal, & Graham	AZ	Livestock grazing
				Hidalgo		

58. The USFS and BLM have undertaken Gila chub conservation activities associated with conference opinions within proposed critical habitat designation. These conservation activities are described below in Exhibit 3-3. The estimated cost of past administrative efforts associated with conference opinions is \$110,000 to \$169,000 (undiscounted dollars), presented in Exhibit 3-4. The estimated cost of past conservation efforts associated with conference opinions is \$47,000 (undiscounted dollars), presented in Exhibit 3-5. The remaining three were conducted for activities outside of the proposed CHD and are not quantified in this analysis.

Exhibit 3-3

**PAST CONSERVATION ACTIVITIES ASSOCIATED WITH
CONFERENCE OPINIONS ON THE GILA CHUB IN PROPOSED CHD AREAS (SINCE 2002)**

Activity	Conservation Activities
Fish Restocking	<ul style="list-style-type: none"> • Monitor the project area annually. • Submit annual monitoring reports. • Post a sign advising recreationists of the presence of fish in the streams and request minimal crossing.
Bank Stabilization	<ul style="list-style-type: none"> • Submit annual report. • Consider planting Huachuca water umbel. • Consider monitoring Gila chub population.
Management Plan	<ul style="list-style-type: none"> • Monitor Gila chub and its habitat. • Submit annual monitoring reports. • Manage riparian areas adjacent to and upstream of Gila chub populations to minimize effects. • Design projects to minimize effects to Gila chub. For projects in occupied habitat incorporate important characteristics of pool habitats in project design. • Remove and repatriate Gila chub before nonindigenous aquatic species control. • Reduce the speed limit to 10 mph at crossings, and post the speed limit at each crossing. • Conduct a public education program. • Avoid livestock crossings which are known to be occupied by Gila chub. • Monitor livestock crossings. • Insure livestock do not linger in crossings. • All new repressos (earthen reservoirs) shall be constructed outside of the 100-year floodplain. • Minimize runoff captured by repressos. • Water depth in repressos may not exceed four feet. • Repressos shall be used only to water cattle and will be allowed to dry when not needed to water cattle. • Minimize potential for repressos to release nonindigenous species. • Conduct personnel education programs.
Fire Management	<ul style="list-style-type: none"> • Coordinate fire suppression actions with Service. • If take is likely to occur due to suppression activities, collect and salvage fish. • Monitor areas affected by fire suppression actions. • Submit annual monitoring report.
Livestock Grazing	<ul style="list-style-type: none"> • Repair existing exclosures. • Inspect and maintain exclosures three times a year. • Minimize channel and floodplain alteration during repairs of fences. • Monitor for Gila chub in and 0.75 miles downstream of the activity area. • Record downed or damaged exclosure fencing.

Exhibit 3-4			
TOTAL ESTIMATED PAST ADMINISTRATIVE COSTS OF GILA CHUB CONFERENCE OPINIONS			
Area	Stream Reach	Low	High
Area 1 Upper Gila River	Dix Creek	\$2,000	\$2,000
	Harden Cienega Creek	\$2,000	\$2,000
	Eagle Creek	\$2,000	\$2,000
	East Eagle Creek	\$2,000	\$2,000
	Subtotal	\$7,000	\$9,000
Area 2 Middle Gila River	Mineral Creek	\$2,000	\$4,000
	Bonita Creek	\$1,000	\$1,000
	Subtotal	\$3,000	\$5,000
Area 3 Babocomari River Area	O'Donnell Canyon	\$9,000	\$15,000
	Turkey Creek	\$2,000	\$4,000
	Post Canyon Creek	\$2,000	\$2,000
	Subtotal	\$14,000	\$20,000
Area 4 Lower San Pedro River Area	Bass Canyon	\$1,000	\$1,000
	Hot Springs Canyon	\$8,000	\$12,000
	Redfield Canyon	\$8,000	\$12,000
	Subtotal	\$16,000	\$26,000
Area 5 Lower Santa Cruz River Area	Cienega Creek	\$19,000	\$31,000
	Mattie Canyon	\$5,000	\$9,000
	Empire Gulch	\$5,000	\$9,000
	Sabino Canyon	\$9,000	\$13,000
	Subtotal	\$39,000	\$62,000
Area 6 Upper Verde River Area	Walker Creek	\$2,000	\$2,000
	Red Tank Draw	\$2,000	\$4,000
	Spring Creek	\$2,000	\$2,000
	Subtotal	\$6,000	\$8,000
Area 7 Aqua Fria River Area	Little Sycamore Creek	\$2,000	\$4,000
	Sycamore Creek	\$2,000	\$4,000
	Indian Creek	\$6,000	\$9,000
	Silver Creek	\$6,000	\$9,000
	Larry Creek	\$4,000	\$7,000
	Lousy Canyon	\$4,000	\$7,000
Subtotal	\$25,000	\$39,000	
Total		\$110,000	\$169,000
Note(s): Totals may not sum due to rounding. Administrative costs are discussed in Appendix A.			

Exhibit 3-5				
TOTAL ESTIMATED PAST COSTS OF PROJECT MODIFICATIONS OF GILA CHUB CONFERENCE OPINIONS				
Area	Stream Reach	Undiscounted Value	Present Value 3%	Present Value 7%
Area 3 Babocomari River Area	O'Donnell Canyon	\$18,000	\$19,000	\$21,000
	Subtotal	\$18,000	\$19,000	\$21,000
Area 4 Lower San Pedro River Area	Hot Springs Canyon	\$1,000	\$1,000	\$1,000
	Redfield Canyon	\$1,000	\$1,000	\$1,000
	Subtotal	\$2,000	\$2,000	\$2,000
Area 5 Lower Santa Cruz River Area	Cienega Creek	\$3,000	\$3,000	\$3,000
	Mattie Canyon	\$3,000	\$3,000	\$3,000
	Empire Gulch	\$3,000	\$3,000	\$3,000
	Sabino Canyon	\$18,000	\$19,000	\$21,000
	Subtotal	\$27,000	\$29,000	\$31,000
Total		\$47,000	\$50,000	\$52,000

Note: Totals may not sum due to rounding.

3.3 Gila Chub Specific Management Activities

59. Gila chub specific management activities have occurred in the past. Past Gila chub management efforts include monitoring, stocking, and habitat restoration. Some of the efforts pre-date the proposed listing. Efforts that pre-date the proposed listing are discussed in this section, however, costs of these efforts are not quantified. Past Gila chub management efforts are discussed below by stream reach, where applicable.

Area 1: Upper Gila River

- **Turkey Creek.** Gila chub population monitoring began in 2003 in response to the Dry Lakes Complex fire.³⁶ Stream surveys were conducted at the upper end of occupied habitat prior to and after ash and debris flows. Gila chub monitoring is estimated to be less than \$1,000 per year within the Turkey Creek stream reach.³⁷ Therefore, this analysis estimates the total past Gila chub monitoring costs in the Turkey Creek stream reach to be \$2,000 (undiscounted dollars).

³⁶ Written communication by Jerry Monzingo, Fisheries Biologist, Gila National Forest, May 13, 2005.

³⁷ Personal communication with Jerry Monzingo, Fisheries Biologist, Gila National Forest, June 9, 2005.

Area 3: Babocomari River

- **Turkey Creek.** The Turkey Creek stream reach was stocked with 150 Gila chub in 1998.³⁸ Since this stocking occur prior to the proposed listing of the Gila chub this analysis does not quantify the costs of this effort.
- **O'Donnell Creek.** Habitat restoration and Gila chub re-establishment occurred in O'Donnell Canyon stream reach in 2002.³⁹ The costs associated with this habitat restoration and restoration effort are estimated to have been \$40,000.⁴⁰

Area 4: Lower San Pedro

- **Redfield Canyon.** In the Redfield Canyon stream reach annual Gila chub monitoring efforts have been undertaken since 1998.⁴¹ Gila chub monitoring is expected to cost less than \$1,000 annually.⁴² The cost of Gila chub monitoring in the Redfield Canyon stream reach since 2002 may have been \$3,000 (undiscounted dollars).

Area 5: Santa Cruz River

- **Sabino Canyon.** Sabino Canyon's aquatic habitat was restored in 1999.⁴³ This restoration effort involved the removal of non-native green sunfish above the Sabino Canyon dam. Since the completion of the non-native species removal the stream reach has been monitored annually. Total Gila chub monitoring efforts since 2002 are estimated to have cost \$3,000 (undiscounted dollars).⁴⁴ The costs of future monitoring efforts are quantified in Section 8. The cost of non-native species removal is estimated in the next section. In 2002, a persistent drought reduced the available Gila chub habitat to a few isolated pools. The USFS set up an emergency holding tank for Gila chub in case the pools dried, and also transported water to drying pools. In 2003, Gila chub were salvaged from Sabino Canyon during the Aspen Fire. Gila chub were returned to the stream reach over

³⁸ U.S. Fish and Wildlife Service. Proposed Rule to List the Gila Chub as Endangered With Critical Habitat. (67 FR 51948) August 9, 2002.

³⁹ Written communication from Robert Bettaso, Arizona Game and Fish Department, June 21, 2005.

⁴⁰ Written communication Ted Cordery, Endangered Species Coordinator, Arizona State Office, Bureau of Land Management, July 20, 2005.

⁴¹ U.S. Fish and Wildlife Service. Reinitiation of Biological Opinion 2-21-98-F-399; Continuation of Livestock Grazing on the Coronado National Forest. October 24, 2002.

⁴² The annual cost of Gila chub monitoring is assumed to be similar to the cost of monitoring in the Turkey Creek stream reach (New Mexico), \$1,000. The annual cost of Gila chub monitoring in the Turkey Creek stream reach was provided by personal communication with Jerry Monzingo, Fisheries Biologist, Gila National Forest, June 9, 2005.

⁴³ U.S. Fish and Wildlife Service. Reinitiation of Biological Opinion 2-21-98-F-399; Continuation of Livestock Grazing on the Coronado National Forest. October 24, 2002.

⁴⁴ The annual cost of Gila chub monitoring is assumed to be similar to the cost of monitoring in the Turkey Creek stream reach (New Mexico), \$1,000. The annual cost of Gila chub monitoring in the Turkey Creek stream reach was provided by personal communication with Jerry Monzingo, Fisheries Biologist, Gila National Forest, June 9, 2005.

a year later, in May 2005.⁴⁵ The costs of Gila chub evacuation and reestablishment are estimated to have been \$42,000 to \$45,000. Evacuation and reestablishment are discussed in greater detail in Section 8.4.

Area 7: Agua Fria River

- **Larry Creek and Lousy Creek.** Larry and Lousy Creek stream reaches were stocked with Gila chub from Silver Creek in 1995. Since 1995 these two stream reaches have been monitored annually. Total Gila chub monitoring efforts since 2002 are estimated to have cost \$3,000 (undiscounted dollars).⁴⁶

3.4 Non-Native Species Management

60. Non-native species management has occurred in the past to benefit the Gila chub. Past non-native species management efforts have included removal of green sunfish. Efforts that pre-date the proposed listing are discussed in this section, however, costs of these efforts are not quantified. Past non-native species management efforts are discussed below by stream reach, where applicable.

Area 3: Babocomari River

- **O'Donnell Creek.** A multi-agency effort to remove non-native species has occurred in the O'Donnell Canyon stream reach. Green sunfish were removed from the canyon in the 2002 field season.⁴⁷ The cost of non-native species management in this reach is estimated to have been \$15,000 (undiscounted dollars).⁴⁸

Area 5: Santa Cruz River

- **Sabino Canyon.** As discussed above, Sabino Canyon's aquatic habitat was restored in 1999.⁴⁹ This restoration effort involved using piscicides to remove non-native green sunfish above the Sabino Canyon dam in June 1999. Since the completion of the non-native species removal the stream reach has been monitored annually. The cost of Gila chub monitoring efforts is estimated above.

⁴⁵ Written communication from Don Mitchell, Fisheries Program Manager, Region V, Arizona Game and Fish Department, May 10, 2005. Written communication from Service Biologist, May 11, 2005.

⁴⁶ The annual cost of Gila chub monitoring is assumed to be similar to the cost of monitoring in the Turkey Creek stream reach (New Mexico), \$1,000. The annual cost of Gila chub monitoring in the Turkey Creek stream reach was provided by personal communication with Jerry Monzingo, Fisheries Biologist, Gila National Forest, June 9, 2005.

⁴⁷ U.S. Fish and Wildlife Service. Proposed Rule to List the Gila Chub as Endangered With Critical Habitat. (67 FR 51948) August 9, 2002.

⁴⁸ Written communication from Ted Cordery, Bureau of Land Management, July 20, 2005.

⁴⁹ U.S. Fish and Wildlife Service. Reinitiation of Biological Opinion 2-21-98-F-399; Continuation of Livestock Grazing on the Coronado National Forest. October 24, 2002.

The cost of non-native species removal is estimated to have been \$15,000 (undiscounted dollars).⁵⁰

⁵⁰ Written communication from Ted Cordery, Bureau of Land Management, July 20, 2005.

61. The Service indicates in the proposed rule that "water demands threaten the existence of southern Arizona perennial surface water in the Gila Basin, as well as the species that depend on it."⁵¹ Water uses specifically cited by the Service as contributing to the degradation the Gila chub's habitat include surface water diversions, impoundments, groundwater pumping, and channelization. In Arizona, surface water is used primarily for irrigation of agricultural land, whereas groundwater is pumped extensively for municipal, agricultural, and private uses. In evaluating hydrogeologic connections between surface water and groundwater, the Service concludes "groundwater pumping has been a major factor in loss of surface water in springs, streams, and cienegas of Arizona."⁵² The effects of water use on the Gila chub and its habitat are also expected to increase with increasing human population.
62. This analysis examines the past and future economic effects resulting from Gila chub conservation activities affecting water use and users within proposed Gila chub CHD. This section presents relevant background information, an overview of the methodology used to evaluate water use activities and associated economic impacts, and the results of the analysis.

4.1 Introduction to Water Analysis

63. While groundwater pumping and surface water use are identified as a threat to the Gila chub in the proposed rule, no formal conference opinions on Gila chub have been issued that relate to water supply or water management issues. Further, there is little history of water management changes that have occurred to accommodate native fish within the proposed CHD area. One past consultation with the Department of Defense at Fort Huachuca (which lies outside of proposed CHD) did address the 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

⁵¹ Federal Register, Volume 67, Number 154, August 9, 2002, page 51950.

⁵² *Ibid.*, page 51950.

species.⁵³ Because it appears that the 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 Gila chub conservation activities. This analysis also assesses whether any surface water uses could be affected by Gila chub conservation efforts.

64. Published literature describing Gila chub streamflow requirements do not exist. However, the Service determined that roundtail chub habitat is essentially eliminated when flow drops below 0.3 cubic meters per second (i.e., 10.6 cubic feet per second).⁵⁴ Unlike Gila chub, the roundtail chub is more typically found in larger streams closer to stem waterways. In addition, the Gila chub is a more “plastic” species found in a wider variety of habitats.⁵⁵ Given this information, the Service believes a conservative approach is to assume that the Gila chub requires a minimum of 10 cubic feet per second (cfs) of streamflow.⁵⁶ Where possible, this analysis considers streamflow requirements coupled with actual flow data for each area to identify and quantify potential impacts associated with proposed critical habitat for the Gila chub.⁵⁷ However, it is difficult to rely solely on this approach due to incomplete flow data for proposed Gila chub critical habitat as well as the need to understand current and future water demand and management activities.
65. As a result, this analysis initially relies on quantitative and qualitative assessments of water use and demand in proposed CHD areas. Specifically, based on information in two databases maintained by the State of Arizona, this analysis identified water uses and users in proposed critical habitat to understand in which CHD areas water use could be affected by the designation. First, the location of all surface water intakes and groundwater wells used by community water systems was mapped from GIS data provided by the Arizona Department of Environmental Quality (ADEQ). This step revealed four groundwater wells and no surface water intakes located within proposed CHD used to supply community water systems. The four wells included two operated by the City of Safford in Bonita Creek and two operated by the U.S. Forest Service, one each at Prescott National Forest and Coronado National Forest.
66. Second, a similar query was performed on a dataset maintained by the Arizona Department of Water Resources (ADWR) on the location, type, and size of every groundwater well in Arizona. This step identified 57 wells located in critical habitat, including the four wells operated by community water systems identified in the first step. Exhibit 4-1 presents detailed information on the identified wells, and Exhibit 4-2 presents the location of proposed Gila chub CHD and the 57 wells. Of these 57 wells:

⁵³ 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.

⁵⁴ Fish and Wildlife Coordination Act Substantiating Report: Central Arizona Project, Verde and East Verde River Water Diversions, Yavapai and Gila counties, Arizona, U.S Fish and Wildlife Service, 1989.

⁵⁵ Personal communication with Rob Bettaso, Arizona Game and Fish Department, June 17, 2005.

⁵⁶ Written communication with Service, Arizona Ecological Services Office, July 1, 2005.

⁵⁷ The Service anticipates working with water users to maintain adequate stream flow in critical habitat segments by focusing on minimum stream flow that would meet the needs of the Gila chub (written communication with Service, Arizona Ecological Services Office, July 1, 2005).

- 19 are exempt wells pumping fewer than 35 gallons per minute, primarily for private, domestic use;
- 16 are monitoring or exploration wells;
- 11 are operated by the City of Safford for their municipal water supply;
- 5 are large, non-exempt wells in the Cienega Creek unit; and
- 6 are relatively small wells scattered across the other proposed CHD units.

Of these, the exempt wells, monitoring/exploration wells, and other small, non-exempt private wells are unlikely to be affected by Gila chub conservation activities due to their size. On the other hand, the wells operated by the City of Safford as wells as those located in the Cienega Creek stream reach are large enough to potentially be affected.

67. We also used a second, qualitative approach to identify proposed CHD areas where water scarcity or increasing water demand could be an issue. We reviewed public comments on the proposed rule and discussed current stream conditions and potential impacts associated with water scarcity and increasing water demand with water managers, natural resource specialists, and state and Federal biologists during meetings and phone conversations.⁵⁸ These discussions highlighted concern regarding: (1) the City of Safford’s continued use of groundwater from the Bonita Creek reach; (2) increasing water demand stemming from development in the Prescott area affecting proposed critical habitat in Williamson Valley Wash; and (3) water scarcity in the Cienega Creek proposed CHD area near Tucson.

68. Comparing this qualitative information on water use with the data presented in Exhibit 4-1 confirms the location of Safford’s wells in proposed CHD of Bonita Creek and further highlights water use in Cienega Creek as a concern, therefore suggesting potential economic impacts related to water use. Existing well data do not suggest a link between increasing water use in the Prescott area and critical habitat impacts in the proposed CHD area of Williamson Valley Wash. Specifically, there are only two exempt private wells located in the unit. Furthermore, the City of Prescott has abandoned the option to pursue additional water rights in the Williamson Valley Wash area (22 miles from Prescott), an alternative that was under consideration at the time of the proposed listing.⁵⁹ This suggests that the only stream reaches with potential for costs related to Gila chub conservation activities and water development are Bonita Creek and Cienega Creek. Each of these areas is discussed in more detail below.

⁵⁸ Meetings with Service, Phoenix Ecological Services Office, and Bill Werner, Arizona Department of Water Resources; phone conversations with Rob Bettaso, Arizona Game and Fish Department, Albert Sillas, U.S. Forest Service.

⁵⁹ Letter from Brad Huza, Environmental Services Director, City of Prescott to Brian Hanson, Acting Field Supervisor, U.S. Fish and Wildlife Service, Phoenix, Arizona, September 23, 2002; and personal communication with John Moffitt, City Attorney, City of Prescott, May 19, 2005.

Exhibit 4-1

WELLS LOCATED IN GILA CHUB PROPOSED CRITICAL HABITAT DESIGNATED AREAS

Area	COUNTY	CHD Unit	Well Type	Water Use	Pump Rate (gallons/minute)	Well Owner
1 Upper Gila River	Greenlee	Eagle Creek	Non Exempt	Irrigation	100	Devonts; J. Gust
		Eagle Creek	Non Exempt	Irrigation	60	J.R. Gust, J.D. Etal
		Eagle Creek	Exempt	Domestic	10	Errol Brown
2 Middle Gila River	Graham	Bonita Creek [11]	Non Exempt	Domestic	700-1426	City of Safford
		Bonita Creek [13]	Monitor or Piezometer	Test	0	City of Safford
	Gila	Mineral Creek	Exempt	Stock	0	Tonto Nat'l Forest
		Mineral Creek	Exempt	Stock	6	Meueller Revoc. Trust
3 Babocomari River Area	Santa Cruz	O'Donnell Canyon	Exempt	Stock	30	J.R. Jelks, Jr.
		O'Donnell Canyon	Non Exempt	Stock	35	Marilyn J. Parker
		O'Donnell Canyon	Exempt	Domestic	16	Marilyn J. Parker
		Turkey Creek (AZ)	Exempt	Domestic	0	B. Lindsey
5 Lower Santa Cruz River Area	Pima	Sabino Canyon	Exempt	Recreation	0	Coronado Nat'l Forest
		Cienega Creek -BLM [3]	Non Exempt	Irrigation	35-600	BLM-Safford District
		Cienega Creek -BLM	Non Exempt	Stock	700	BLM-Safford District
		Cienega Creek -County	Non Exempt	Domestic	840	Vail Water Company
		Cienega Creek -County	Monitor or Piezometer	Monitoring	600	Pima County Flood
		Cienega Creek -County	Exempt	Domestic	25	Union Pacific Railroad
		Cienega Creek -County [2]	Exploration	None	0	Empirita Ranch, Inc.
6 Upper Verde River Area	Yavapai	Red Tank Draw	Exempt	Domestic	15	Paul Webb
		Spring Creek	Exempt	Domestic	0	Spring Hill Ranch, LLC
		Spring Creek	Non Exempt	Domestic	40	J. H. Waddell
		Williamson Valley Wash	Exempt	Domestic	10	Paul Swaner
		Williamson Valley Wash	Exempt	Stock	0	Peter B. Swaner
7 Aqua Fria River Area	Yavapai	Indian Creek	Exempt	Domestic	0	Kelton Cattle, Co.
		Indian Creek	Exempt	Stock	10	Kelton Cattle, Co.
		Little Sycamore	Non Exempt	Irrigation	75	B. Teskey
		Little Sycamore	Exempt	Irrigation	10	P.D. Teskey
		Little Sycamore [2]	Exempt	Domestic	0-35	F.C. Teskey
		Sycamore	Exempt	Stock	15	Prescott Nat'l Forest
		Sycamore	Non Exempt	Domestic	100	Pine Mountain Ranch
		Sycamore	Exempt	Domestic	25	Pine Mountain Ranch

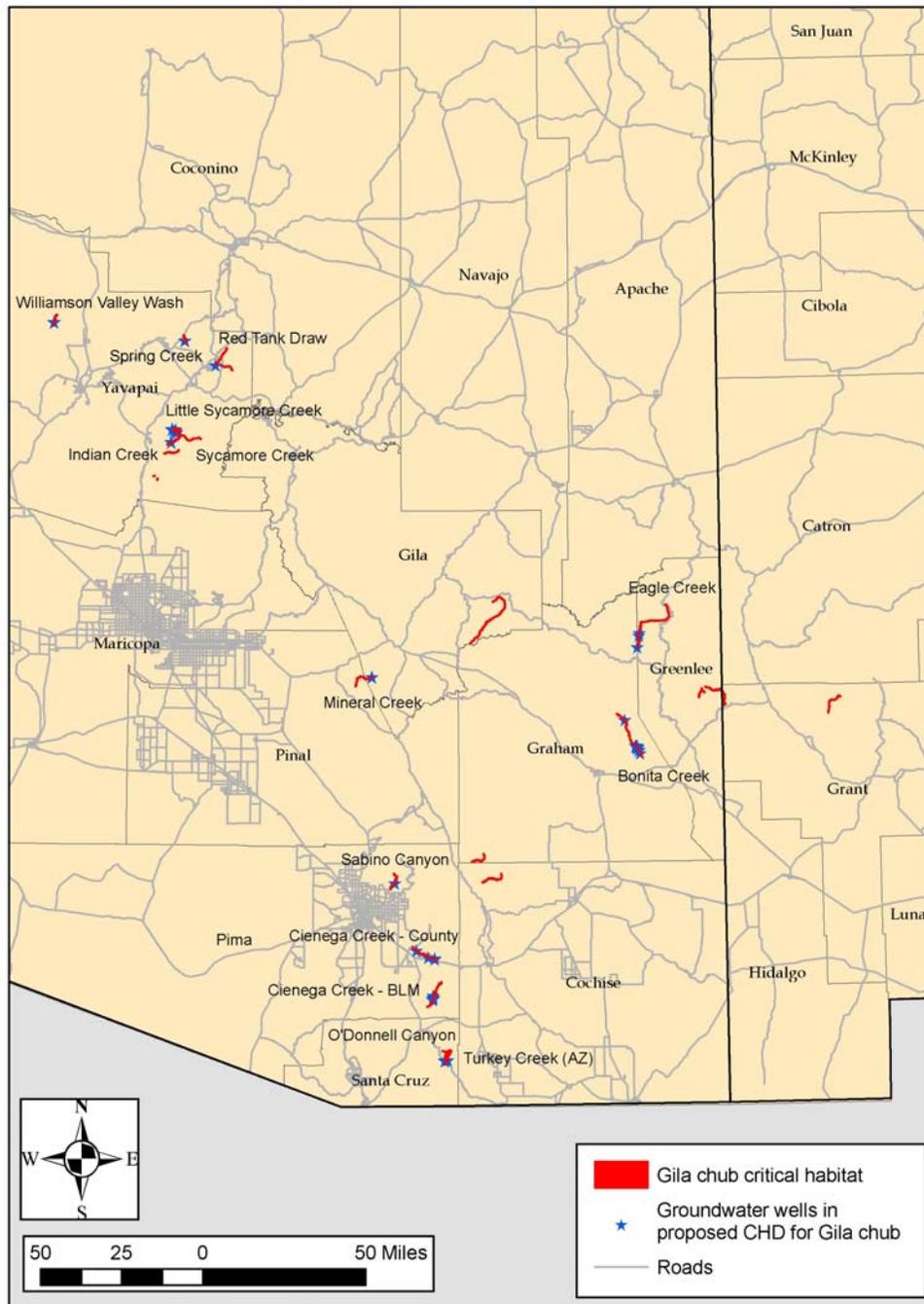
Notes:

- Numbers in [brackets] indicate that multiple wells of this description exist within the unit.
- No wells were found in Area 4: Lower San Pedro River Area.
- Definitions: Exempt = Pumps 35 gpm or less; Non-Exempt = Pumps more than 35 gpm; Monitor or Piezometer = Pump operates only to collect water for monitoring purposes; Exploration = Pump operates only to gather water for exploration (minerals, etc.); Stock = Pumps water for livestock use; Recreation = Pumps water for recreational use; Test = Pumps to gather water for testing purposes.

Source: 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.

Exhibit 4-2

GROUNDWATER WELLS LOCATED IN GILA CHUB PROPOSED CRITICAL HABITAT AREAS



4.2 Economic Impacts Related to Water Management

Middle Gila River Area

Bonita Creek - City of Safford

69. The City of Safford's infiltration gallery collects groundwater from an artesian well in the Bonita Creek streambed.⁶⁰ This gallery defines the lower end of the 39.6-mile proposed critical habitat designation in Bonita Creek. Bonita Creek is ephemeral at the infiltration gallery and for some distance both upstream and downstream of the gallery: the streambed is dry for at least a quarter of a mile upstream from the gallery and perhaps a half of a mile in all. It is difficult to assess to what extent Bonita Creek is naturally ephemeral in this stretch, or to what extent the City's water diversion contributes to the ephemeral characteristic.⁶¹ The City of Safford owns full rights to the source at the infiltration gallery and can therefore increase its existing diverted flow of 3,876 acre-feet/year up to a maximum flow of 5,310 acre-feet/year (AFY). Assuming the average household in Arizona consumes 0.4 AFY, the City currently is able to serve approximately 9,700 households with groundwater from Bonita Creek and could serve approximately 13,300 households in the future at its maximum flow.⁶²
70. Safford's service area includes 18,900 people across 132 square miles in the communities of Safford, San Jose, Solomon, Thatcher, Central, and a portion of unincorporated Graham County south of Safford.⁶³ System-wide water demand has grown in recent years and is expected to continue to grow in tandem with increasing population in the water system's service area. In 2003, Safford delivered approximately 7,400 AFY of water and projected demand of 9,500 AFY by 2006.⁶⁴
71. Data on the City's water sources are presented in Exhibit 4-3. In addition to the Bonita Creek infiltration gallery, the City relies on eight active production wells for the

⁶⁰ An infiltration gallery is defined by EPA as a sub-surface groundwater collection system, typically shallow in depth, constructed with open-jointed or perforated pipes that discharge collected water into a watertight chamber from which the water is pumped to treatment facilities and into the distribution system. Source: EPA. Terms of Environment: Glossary, Abbreviations and Acronyms. Accessed at <http://www.epa.gov/OCEPAterms/iterns.html> on August 10, 2005.

⁶¹ The Service agrees that this stretch of Bonita Creek could be naturally ephemeral, and therefore believes that the City of Safford's existing infiltration gallery and water use is not adversely affecting the Gila chub. Furthermore, the Service believes that the infiltration gallery is actually a benefit to the Bonita Creek population of Gila chub because the ephemeral stretch acts as a barrier to the movement of nonnative species upstream. Written communication with Service Arizona Ecological Services Office, July 1, 2005.

⁶² "Water Conservation In and Around the Home," Waskom, R. and Neibauer, M., accessed June 24, 2005 at <http://www.ext.colostate.edu/pubs/consumer/09952.html>; Sedona Community Plan: Water Resources Element, December 10, 2002, accessed June 24, 2005 at <http://www.sedonaaz.gov/documents/view.aspx?PK=60>.

⁶³ Population served data from U.S. EPA's Envirofacts database, accessed at <http://www.epa.gov/enviro/index.html> on June 24, 2005. Data maintained in Envirofacts as of April 9, 2005 does not reflect the recent transition of the water system from an independent entity (Gila Resources) to an operation within the City of Safford's municipal structure (personal communication with Jay Howe, Utilities Manger, City of Safford, June 10, 2005).

⁶⁴ "Agreement Between Gila River Indian Community, The San Carlos Irrigation and Drainage District, The United States and The City of Safford," Presentation by Lee Storey at the City of Safford Council Meeting, September 13, 2004.

potable water: the Morris wells, the Alder well, Carrasco well, and the Kempton wells. The City’s remaining water sources produce lower-quality water that generally requires additional treatment; these wells are used as backup sources and to supply the City’s public park and golf course. Water from the Bonita Creek infiltration gallery represented almost 53 percent of the water delivered to customers in 2003. In terms of maximum capacity, the City potentially has access to almost 23,000 AFY of water, of which the Bonita Creek infiltration gallery alone represents 30 percent and the remaining active production wells represent almost 47 percent.

Exhibit 4-3				
CITY OF SAFFORD’S WATER SOURCES				
Water Source	Description	Approximate Current Use (acre-feet/year)	Maximum Flow (acre-feet/year)	
Bonita Creek Infiltration Gallery (in CHD)	Primary water source	3,900	5,310	
Morris #1	Production well	3,000	970	
Morris #2	Production well		480	
Morris #3	Production well		480	
Alder Well	Production well		1,940	
Carrasco Well	Production well		2,900	
Kempton Wellfield	Production wells (3)		5,480	
Subtotal				17,560
Well #15	Back-up source			2,420
Smith Well	Back-up source			1,610
Clonts Well	Low quality back-up			560
Mt. Graham Wellfield	Non-potable; serves golf course	500	730	
Total		7,400	22,890	
Sources: “History of Gila Resources,” accessed June 8, 2005 at http://www.gilaresources.com/asp_pages/about_us/about_us_gr_info.asp ; “Agreement Between Gila River Indian Community, The San Carlos Irrigation and Drainage District, The United States and The City of Safford,” presentation by Lee Storey at the City of Safford Council Meeting, September 13, 2004.				

Past Impacts

72. In 2003, the City of Safford commissioned an environmental and surveying company to complete fisheries habitat assessments on Lower Bonita Creek (defined as downstream of the City’s infiltration gallery) and Upper Bonita Creek (defined as upstream of the City’s infiltration gallery). According to the assessment reports, the “purpose of the assessment was to determine the potential of [Lower/Upper] Bonita

Creek to support Gila chub, a fish proposed for listing as endangered by the Service.”⁶⁵
The cost of these assessments is not known at this time.⁶⁶

Future Impacts

73. According to the terms of the Gila River Indian Communities agreement signed in 2004, the City cannot divert more than 9,700 AFY from existing sources in an area of the Gila River encompassing most of Safford’s water sources.⁶⁷ Thus, the City is unlikely to acquire additional water rights at Bonita Creek in the foreseeable future and it is possible that the City of Safford’s ability to make use of its water source in Bonita Creek could be limited as a result of Gila chub conservation measures. Under this scenario, the City could lose the ability to expand its use of the infiltration gallery, thereby forfeiting the currently unused 1,434 acre-feet/year of water. In a worst case scenario, the Service could recommend, or the City could decide, that in order to prevent take of Gila chub the City must completely abandon the Bonita Creek infiltration gallery, resulting in a loss of the City’s full water rights to 5,310 acre-feet/year.⁶⁸ While this scenario appears unlikely, this analysis presents information on this scenario in order to understand the potential magnitude of impacts. While the City could in the very short term replace any lost volume from Bonita Creek sources from other active production wells and existing back-up wells, abandoning the Bonita Creek infiltration gallery would result in an economic impact to the City. The impact can be viewed in terms of a lost capital investment; the loss of an inexpensive, reliable, local, high-quality water supply requiring very little treatment and transportation; and a constraint on the City’s ability to flexibly and effectively manage regional water supply and demand.
74. As a proxy for the value of this economic impact, this analysis calculates the cost to the City to replace water rights for a volume equal to the potential lost volume from Bonita Creek, both the currently unused volume (1,434 acre-feet/year) and the volume of the entire water right (5,310 acre-feet/year).

⁶⁵ “Lower Bonita Creek Fisheries Habitat Assessment,” prepared for City of Safford by Darling Environmental and Surveying, Ltd., Tucson, AZ, 2003, page 1; and “Upper Bonita Creek Fisheries Habitat Assessment,” prepared for City of Safford by Darling Environmental and Surveying, Ltd., Tucson, AZ, 2003, page 1.

⁶⁶ Personal communication with Jay Howe, Utilities Systems Manager, City of Safford, June 10, 2005.

⁶⁷ *Ibid.*

⁶⁸ Stream flow data for the upper Bonita Creek area comprising proposed CHD is not available; the only gauge station maintained by the U.S. Geological Survey in Bonita Creek is downstream of proposed CHD.

Exhibit 4-4				
SAMPLING OF RECENT WATER PURCHASE TRANSACTIONS IN ARIZONA				
Location	Date of Transaction	Water Type	Quantity (acre-feet)	Cost per Acre-Foot (Undiscounted dollars)
Pinal Active Management Area (AMA)	May 2003	Non-irrigation groundwater	136	\$2,900
Tucson AMA	July 2003	Non-irrigation groundwater	27	\$2,000
Tucson AMA	May 2003	Non-irrigation groundwater	530	\$2,000
Phoenix AMA	September 2003	Groundwater	3,020	\$1,000
Phoenix AMA	January 2004	Non-irrigation groundwater	110	\$1,100
Unweighted Average:				\$1,800
Source: <i>Water Strategist</i> , February 2004.				

75. Research into historical water transactions in Arizona indicate that the value of water rights continues to increase, a predictable trend given the general water scarcity in the state. Exhibit 4-4 presents information on recent, relevant water transactions in Arizona. At an average cost of \$1,800 per acre-foot, replacing 1,434 acre-feet of water would cost \$2.6 million to acquire the rights, while replacing 5,310 acre-feet of water rights would cost \$9.6 million. Exhibit 4-5 summarizes these costs. In considering this estimate, several factors could affect positively or negatively the average cost per acre-foot of replacement water rights:

- **Location of replacement water rights.** If the location of the acquired water rights is not in or near the region of the service area, the average cost of the rights could increase to reflect higher transportation costs or higher transaction costs associated with water exchanges to access nearby water.
- **Size of water rights.** Similarly, it may be difficult to find a set of water rights large enough to cover the full volume of water needing to be replaced. In this case, transaction costs related to locating and transferring a number of water rights could be higher, driving up the average cost.
- **Water quality.** Currently, the water produced at the Bonita Creek infiltration gallery is of high quality requiring only minimal chlorination. Other water sources in the Safford area are high in fluorides, manganese, and iron. Replacement water sources may require more extensive treatment, adding an additional cost to using a new water source.

Exhibit 4-5

**WATER RIGHTS REPLACEMENT COSTS FOR THE MIDDLE GILA RIVER AREA
(CITY OF SAFFORD)**

Water Rights (AFY)		Cost in Undiscounted Dollars		Present Value (3% Discount Rate)		Present Value (7% Discount Rate)		Annualized Cost (3%)		Annualized Cost (7%)	
Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
1,434	5,310	\$2,581,200	\$9,558,000	\$1,152,000	\$4,266,000	\$1,914,100	\$7,088,000	\$77,400	\$286,700	\$180,700	\$669,000

Note: Based on an average water right value of \$1,800 per acre-foot (see Exhibit 4-4).

Upper Gila River Area

Cienega Creek - Vail Water Company

76. Vail Water Company is a private company with seven groundwater wells serving most of unincorporated Vail, Arizona. One of the seven wells – Well #5 - is located in proposed critical habitat for Cienega Creek. Although capable of pumping 840 gpm, the well is not used by Vail Water Company for domestic supply due to high levels of certain constituents; it is only used for monitoring and testing.
77. This same stretch of Cienega Creek is currently the focus of a streamflow restoration effort under the Sonoran Desert Conservation Plan (SDCP), which addresses the Gila chub as well as numerous other endangered species. One component of the streamflow restoration effort is the proposed acquisition by SDCP of a one-acre inholding within the Cienega Creek Natural Preserve that contains Vail Water Company’s Well #5. This acquisition and planned restoration of the natural streamflow would benefit many of the SDCP’s endangered species, including the Gila chub. According to the SDCP, under this arrangement “the Vail Water Company will need a replacement source of water for its development, either groundwater pumped from outside the Preserve, effluent, or [Colorado River water delivered via the Central Arizona Project].”⁶⁹
78. The U.S. Geological Survey has gathered some data on stream flow at two gauge stations in Cienega Creek. Data from a gauge five miles upstream of proposed CHD indicate low average stream flow in recent years: 0.94 cfs in 2003 and 0.88 cfs in 2004.⁷⁰ USGS also maintains much older stream flow data from a second gauge at the upstream boundary of proposed CHD, where average annual stream flow was 2.65 cfs between 1969 and 1974 (with a range of 0.84 and 6.21 cfs). These stream flow data are all below the Service’s assumed minimum stream flow required for the Gila chub of 10 cfs.
79. Although Vail Water Company does not draw water from Well #5, the company could begin pumping water from the well for non-potable uses with relative ease and

⁶⁹ Sonoran Desert Conservation Plan, Riparian Restoration: Present Projects, as described at <http://www.co.pima.az.us/cmo/sdcp/sdcp2/>, accessed on June 17, 2005.

⁷⁰ Data for Gauge Station 09484550 on Cienega Creek from <http://nwis.waterdata.usgs.gov/az/nwis/inventory>.

could use water from the well for potable use with some treatment. Therefore, future economic impacts of Gila chub conservation activities could conservatively be assumed to be equal to the replacement cost of water rights for an equivalent volume of water that Vail Water Company is currently able to pump from its Cienega Creek well: 840 gpm, or 1,355 acre-feet/year. At \$1,800 per acre-foot, the total replacement cost would be \$2.4 million. However, it is important to note that the water rights assumed to be replaced are not currently in use. In addition, the Company plans on meeting future increases in water demand by drawing on other existing wells or drilling new wells rather than relying on the well in proposed CHD, thus reducing the likelihood of a need for water rights replacement in CHD areas.⁷¹ In addition, the Sonoran Desert Conservation Plan and Pima County may attempt to purchase the Vail Water Company well in question as part of an effort to restore streamflow in Cienega Creek. Thus, the company may be partially compensated for the replacement of these water rights regardless of Gila chub CHD. Therefore, it is difficult to estimate impacts on the Vail Water Company without knowing the actual out-of-pocket costs related to Gila chub conservation activities or any potential off-setting compensation from selling the well.

Cienega Creek - BLM-Safford District

80. BLM owns and operates four groundwater wells in the proposed critical habitat around Cienega Creek, three of which are categorized as irrigation wells and one as a livestock well. While the current actual pumping rate is unknown, these four wells have the capacity to pump 700, 600, 35, and 35 gallons per minute. According to BLM staff, in the past the larger wells were used for irrigation, although the land has since passed to BLM ownership and has not been irrigated for approximately 10 years. In aggregate, the wells can pump 1,300 gpm, or 2,211 acre-feet/year. As a result of Gila chub conservation activities, BLM could potentially be restricted in its use of water from these wells.
81. Future economic impacts are equivalent to the cost of water rights for a volume of water up to the pumping capacity of the four wells, or 2,211 acre-feet/year. At \$1,800 per acre-foot, total replacement cost would be almost \$4.0 million.

⁷¹ Personal communication with Manny Oros, Operations Manager, Vail Water Company, July 15, 2005.

Exhibit 4-6						
WATER RIGHTS REPLACEMENT COSTS FOR THE UPPER GILA RIVER AREA						
Water User	Water Rights (AFY)	Cost in Undiscounted Dollars	Present Value (3% Discount Rate)	Present Value (7% Discount Rate)	Annualized Cost (3%)	Annualized Cost (7%)
Vail Water Company	1,355	\$2,439,000	\$1,089,000	\$1,809,000	\$73,000	\$171,000
BLM – Safford District	2,211	\$3,979,800	\$1,776,000	\$2,951,000	\$119,000	\$279,000
Total	3,566	\$6,418,800	\$2,865,000	\$4,760,000	\$193,000	\$449,000
Note: Based on an average water right value of \$1,800 per acre-foot (see Exhibit 4-4). Numbers may not sum due to rounding.						

4.3 Summary of Impacts

82. Exhibit 4-7 summarizes the past and potential future impacts to water users related to Gila chub conservation activities. Where possible, specific impacts of Gila chub conservation efforts are quantified. Past impacts are limited to costs associated with the City of Safford’s Fisheries Habitat Assessments in 2003. Future impacts on water users resulting from Gila chub conservation activities may include between \$9.0 million and \$16.0 million for the replacement of water from current water sources within proposed CHD areas (undiscounted dollars). Of this amount, between \$2.6 million and \$9.6 million is for the City of Safford to replace water used in the Middle Gila River area and \$6.4 million is for the Vail Water Company and BLM to replace water currently used in the Lower Santa Cruz River area (undiscounted dollars). Both the City of Safford and the Vail Water Company are considered small entities.

Exhibit 4-7

SUMMARY OF PAST AND FUTURE IMPACTS RELATED TO WATER USE

Area	Stream Reach	Description of Impact (year incurred, if known)	Total Cost (Undiscounted dollars)	Total Cost – Present Value (3%)	Total Cost – Present Value (7%)	Annualized Cost (3%)	Annualized Cost (7%)
<i>Past Impacts</i>							
Area 2: Middle Gila River	Bonita Creek	City of Safford Fisheries Habitat Assessments (2003)	Unknown	Unknown	Unknown	Unknown	Unknown
<i>Future Impacts</i>							
Area 2: Middle Gila River	Bonita Creek	Value of replacement water rights – City of Safford	\$2,581,000 - \$9,558,000	\$1,153,000 - \$4,266,000	\$1,914,000 - \$7,088,000	\$77,000 - \$287,000	\$181,000 - \$669,000
Subtotal			\$2,581,000 - \$9,558,000	\$1,153,000 - \$4,266,000	\$1,914,000 - \$7,088,000	\$77,000 - \$287,000	\$181,000 - \$669,000
Area 5: Lower Santa Cruz River Area	Cienega Creek	Value of replacement water rights – Vail Water Company	\$2,439,000	\$1,089,000	\$1,809,000	\$73,000	\$171,000
		Value of replacement water rights – BLM-Safford District	\$3,980,000	\$1,776,000	\$2,951,000	\$119,000	\$279,000
Subtotal			\$6,419,000	\$2,865,000	\$4,760,000	\$193,000	\$449,000
Total			\$9,000,000 - \$15,977,000	\$4,017,000 - \$7,131,000	\$6,674,000 - \$11,848,000	\$270,000 - \$479,000	\$630,000 - \$1,118,000

83. This section describes the past and expected future economic impacts to livestock grazing activities in areas proposed as critical habitat for the Gila chub. Specifically, this analysis estimates direct and indirect economic impacts on grazing due to Gila chub 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 Gila chub and its habitat. The final section provides a summary of the expected future impacts to grazing, by river reach.

5.1 Summary of Impacts to Grazing Activities

5.1.1 Summary of Past Economic Impacts to Grazing Activities

84. Two conference opinions have directly addressed grazing issues for the Gila chub to date. One conference was conducted with USFS for the Coronado National Forest, and addressed 21 threatened and endangered species on this forest. This consultation stated that if any livestock grazing occurred within an existing enclosure at a level resulting in more than five percent utilization of woody riparian species, or if the existing enclosure fence was down for more than two weeks, then take of Gila chub would be assumed to occur. The outcome of the consultation was that USFS was directed to fix a broken enclosure fence within five months of the completion of the biological opinion, and that the enclosure should be inspected three times a year (though this inspection could be performed as part of the inspection reports prepared by the permittee).
85. Another conference opinion addressed possible effects on Gila chub of implementation of the Agua Fria National Monument 's Phoenix Resource Management Plan.⁷² This consultation with BLM identified three allotments that overlap proposed CHD.

⁷² Service, "Formal Conference Opinion on the Existing Phoenix Resource Management Plan for the Agua Fria National Monument," July 14, 2004.

Costs associated with implementing these opinions are included in Section 3, Past Costs. Gila chub and rangeland issues were also discussed generally in the June 2005 consultation on the eleven Forest's Land and Resource Management Plans for Region 3.

5.1.2 Summary of Future Economic Impacts to Grazing Activities

86. Future costs associated with Gila chub conservation activities are anticipated to primarily include costs associated 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 Gila chub 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 Gila chub and reduce the need for additional riparian fencing.⁷³ To be conservative, this analysis assumes that landowners will implement the more costly measures of installing and maintaining riparian fencing. This may result in an overestimate of future costs for some reaches.
87. In addition to fencing costs, costs of constructing off-river drinking water devices are assumed to be required to provide access to drinking water for cattle. This analysis also assumes that administrative costs of conducting consultations on Gila chub will occur: two consultations are anticipated for each stream reach over the next 20 years (administrative costs are discussed in Appendix A). Costs of surveying and monitoring of fish are included for each stream reach in Section 8 of this analysis. Reductions in grazing effort on Federal lands (i.e., reduced permitted or authorized animal-unit months) are not estimated because less than five percent of the acres in each of the 16 allotments that cross CHD have been included in the proposed area. Thus, this analysis assumes that small management changes and the creation of off-river drinking sources will be sufficient to replace access to riparian areas. Few private lands within proposed CHD are estimated to be used for grazing activities.
88. Over 20 years, costs related to grazing conservation activities are estimated to range from \$451,000 to \$3.8 million (undiscounted dollars). Approximately 16 small ranches could be impacted by conservation activities, assuming that each ranch is responsible for one affected allotment. Annual ranch level impacts are estimated to range from \$1,400 to \$11,700 per year, assuming that the ranchers are responsible for funding all conservation activities. However, it is likely that a portion of these costs will be borne by land management agencies. For example, BLM states that the agency usually funds fence construction, while maintenance programs may be shouldered by the permittees.⁷⁴ Staff from Partners for Wildlife state that on private lands, landowners sometimes do not wish to

⁷³ Written communication with Service, Arizona Ecological Services Office, July 1, 2005. For example, in the conference opinion issued for the Agua Fria National Monument, grazing rotation with seasonal rest combined with maintenance of existing fences, bank alteration limits, browsing limits, and herbaceous growth utilization limits were recommended in lieu of additional fencing Service, "Formal Conference Opinion on the Existing Phoenix Resource Management Plan for the Agua Fria National Monument," July 14, 2004.

⁷⁴ Personal communication with Ted Cordery, BLM, Arizona State Office, July 18, 2005.

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.⁷⁵ Estimated future grazing impacts are highest in Areas 1 and 5, with the highest stream reach impacts in East Eagle Creek.

⁷⁵ Service, Partners for Wildlife, Arizona Ecological Services Office, July 15, 2005.

Exhibit 5-1
SUMMARY OF FUTURE COSTS RELATED TO GRAZING ACTIVITIES FOR THE GILA CHUB (2005-2024)

AREA	UNIT	STREAM REACH	Total Undiscounted Dollars		Present Value 3%		Present Value 7%	
			Low	High	Low	High	Low	High
Area 1	Upper Gila River	Turkey Creek (NM)	\$0	\$0	\$0	\$0	\$0	\$0
		Dix Creek	\$11,600	\$88,700	\$8,600	\$66,000	\$6,100	\$47,000
		Harden Cienega Creek (AZ/NM)	\$34,000	\$312,600	\$25,300	\$232,500	\$18,000	\$165,600
		Eagle Creek	\$13,600	\$108,800	\$10,100	\$80,900	\$7,200	\$57,600
		East Eagle Creek	\$61,700	\$562,300	\$45,900	\$418,300	\$32,700	\$297,900
		Total	\$120,900	\$1,072,400	\$89,900	\$797,700	\$64,000	\$568,100
Area 2	Middle Gila River	Mineral Creek	\$39,200	\$354,200	\$29,200	\$263,500	\$20,800	\$187,600
		Blue River	\$0	\$0	n/a	n/a	n/a	n/a
		Bonita Creek	\$20,400	\$177,600	\$15,200	\$132,100	\$10,800	\$94,100
		Total	\$59,600	\$531,800	\$44,400	\$395,600	\$31,600	\$281,700
Area 3	Babocomari River Area	O'Donnell Canyon	\$2,200	\$51,800	\$1,600	\$38,500	\$1,200	\$27,400
		Turkey Creek	\$0	\$0	\$0	\$0	\$0	\$0
		Post Canyon Creek	\$0	\$0	\$0	\$0	\$0	\$0
		Total	\$2,200	\$51,800	\$1,600	\$38,500	\$1,200	\$27,400
Area 4	Lower San Pedro River Area	Bass Canyon	\$5,600	\$8,900	\$4,200	\$6,600	\$3,000	\$4,700
		Hot Springs Canyon	\$5,600	\$8,900	\$4,200	\$6,600	\$3,000	\$4,700
		Redfield Canyon	\$18,100	\$106,400	\$13,500	\$79,100	\$9,600	\$56,400
		Total	\$29,300	\$124,200	\$21,900	\$92,300	\$15,600	\$65,800
Area 5	Lower Santa Cruz River Area	Cienega Creek	\$44,900	\$394,200	\$33,400	\$293,200	\$23,800	\$208,800
		Mattie Canyon	\$17,200	\$144,900	\$12,800	\$107,800	\$9,100	\$76,800
		Empire Gulch	\$19,500	\$167,800	\$14,500	\$124,800	\$10,300	\$88,900
		Sabino Canyon	\$26,800	\$240,400	\$19,900	\$178,800	\$14,200	\$127,300
		Total	\$108,400	\$947,300	\$80,600	\$704,600	\$57,400	\$501,800
Area 6	Upper Verde River Area	Walker Creek	\$22,600	\$147,800	\$16,800	\$109,900	\$12,000	\$78,300
		Red Tank Draw	\$29,100	\$251,600	\$21,600	\$187,200	\$15,400	\$133,300
		Spring Creek	\$9,200	\$63,000	\$6,800	\$46,900	\$4,900	\$33,400
		Williamson Valley Wash	\$0	\$0	\$0	\$0	\$0	\$0
		Total	\$60,900	\$462,400	\$45,200	\$344,000	\$32,300	\$245,000
Area 7	Aqua Fria River Area	Little Sycamore Creek	\$6,800	\$59,200	\$5,100	\$44,000	\$3,600	\$31,400
		Sycamore	\$0	\$0	\$0	\$0	\$0	\$0
		Indian Creek	\$22,400	\$186,400	\$16,700	\$138,700	\$11,900	\$98,700

Exhibit 5-1
SUMMARY OF FUTURE COSTS RELATED TO GRAZING ACTIVITIES FOR THE GILA CHUB (2005-2024)

AREA	UNIT	STREAM REACH	Total Undiscounted Dollars		Present Value 3%		Present Value 7%	
			Low	High	Low	High	Low	High
		Silver Creek	\$21,000	\$191,600	\$15,600	\$142,500	\$11,100	\$101,500
		Larry Creek	\$10,100	\$82,200	\$7,500	\$61,100	\$5,300	\$43,500
		Lousy Canyon	\$9,300	\$74,200	\$6,900	\$55,200	\$4,900	\$39,300
		Total	\$69,600	\$593,600	\$51,800	\$441,500	\$36,800	\$314,400
Total			\$450,900	\$3,783,500	\$335,400	\$2,814,200	\$238,900	\$2,004,200

5.2 Background

89. 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.⁷⁶ Direct grazing effects include trampling or ingesting of Gila chub, 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. The Service also states in its only conference opinion on grazing and Gila chub to date that damage from livestock trampling "begins to occur almost immediately following entry of cattle into a pasture", and that "streambank recovery from long rest periods may be lost within a short period following grazing re-entry."⁷⁷

5.3 Overview of Impacts on Grazing Activities

90. Consultations on livestock grazing have comprised a large segment of past consultations involving native fish in the Gila Basin. Of 102 past consultations, 28 addressed grazing issues on Federal lands (27.5 percent of all consultations). This section discusses the recommended project modifications to provide protection for the Gila chub and other native fishes from livestock that have been developed to date. These modifications can be grouped into three categories: create/maintain livestock exclosures, maintain offsite drinking vessels, and conduct surveying and monitoring. Exhibit 5-2 presents detailed conservation activities recommended by the Service as part of past consultations on native fish in the Gila River Basin.

⁷⁶ 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.

⁷⁷ Reinitiation of Biological Opinion 2-21-98-F-399: Continuation of Livestock Grazing on the Coronado National Forest, October 24, 2002.

Exhibit 5-2

**PROJECT MODIFICATIONS FROM PAST CONSULTATIONS ON GILA TOPMINNOW, SPIKEDACE,
AND LOACH MINNOW**

Create/Maintain Livestock Enclosures:

- The Bureau shall construct a livestock enclosure. No grazing shall occur in certain riparian corridors. (a)
- Livestock numbers on the allotment shall not exceed 350. The fence surrounding the spring and pond shall be inspected and maintained before any livestock gathers in the pasture. The water at the spring and pond will be available to livestock only when they are scheduled to graze the pasture. (b)
- Livestock numbers on the allotment shall not exceed 1,500 animal units year-long. Each crossing lane can be used up to twice per year and all cattle must be moved through the land within 10 days. Cattle must not be allowed to remain in the riparian zone. All proposed riparian enclosures and water gaps will be fenced to exclude cattle within one year from the date of this opinion. (c)
- If any livestock are found within critical habitat, they will be immediately removed. Inspect and maintain all livestock enclosures. If repairs are necessary, make them immediately. (d)
- Trailing of cattle in native fish habitat shall be limited in number and frequency. (e)
- Extend a pre-existing enclosure downstream to include the occupied habitat located below the confluence. Side fences shall be similarly placed and pass-through openings for hikers may be installed. Minimize use by livestock in the perennial/semi-perennial stretch of Redrock Canyon. Methods can include temporary drift fences, gap fences, herding cattle along the road rather than through the riparian area, and restrictions on season of use. (f)
- The Forest Service shall complete within one year of permit issuance those actions designed to draw livestock out of riparian areas including trick tanks, horizontal wells, fence construction or reconstruction, and redesign of the allotment boundary. A gate shall be installed by the Forest Service to ensure that no direct mortality occurs as a result of off-road vehicle and recreational traffic in the active channel. (g)

Maintain Off-River Water Vessels:

- Regularly inspect and maintain livestock drinking water vessels, ensuring that they are dried out six months after their use. (c, i)
- New drinking vessels shall be located outside of the 100-year floodplain (c) and have screen filters at the intake to prevent the entrainment of fish. (h)
- If non-native vertebrates are found in any livestock drinking tanks, the fish shall be removed and the tanks dried out. (f)
- Close roads used for livestock grazing or enclosure construction immediately after use. (f)
- When project activities occur near surface waters, a biological monitor shall be present. Any dead or drying fish or the presence of other species shall be reported within two days of the observation. (f, i, j)

Conduct Surveys and Monitoring

- Inspect, survey, and monitor stream channels, stream banks, and fish habitat. (b, c, d, f)
- Fish population and fish habitat monitoring shall occur on a regular basis. (b, c, j)
- Conduct surveys to determine the presence of non-native fish species. (f)
- Keep records of all monitoring activities. (h, k)
- Submit annual reports on monitoring, construction, and stocking activities. (e, h, j)

Sources:

- (a) 2-21-92-F-213, Tonto National Forest, AZ, September 26, 1997, Gila topminnow;
- (b) 2-21-95-F-303, Tonto National Forest, AZ, September 12, 1995, Gila topminnow;
- (c) 2-21-95-F-177, Pima County, Cienega Creek, AZ, January 8, 1996, Gila topminnow;
- (d) 2-21-95-F-020R, 2-21-01-F-308, 2-21-01-F-105, 2-21-01-F-309, and 2-21-01-F-310, Apache-Sitgreaves National Forest, Greenlee County, AZ, February 26, 2002, loach minnow and spikedace;
- (e) 2-21-96-F-160, southeastern AZ (portions of Greenlee, Graham, Pinal, Cochise, Santa Cruz, and Pima Counties), Safford and Tucson, AZ, September 26, 1997, spikedace, Gila topminnow, and loach minnow;

- (f) 2-21-98-F-399, Coronado National Forest, Hidalgo county, NM and Cochise, Santa Cruz, Pima, Pinal, and Graham counties, AZ, July 29, 1999, Gila topminnow;
- (g) 2-21-99-F-022, Tonto National Forest, Cave Creek Ranger District, AZ, December 19, 2000, Gila topminnow and loach minnow;
- (h) 02-21-95-F-0303-R1, Walnut Spring, Maricopa County, AZ, November 5, 2004, Gila topminnow;
- (i) 2-21-92-F-213, Tonto National Forest, AZ, October 2, 1996, Gila topminnow;
- (j) 2-21-92-F-213, Tonto National Forest, Mesa Ranger District, AZ, February 11, 1994, Gila topminnow;
- (k) 2-21-91-F-060, Yavapai County, AZ, February 21, 1991, Gila topminnow.

91. The past consultations on grazing that addressed Gila chub are in keeping with the Service’s position that even short-term grazing in habitat areas may adversely affect the Gila chub. This follows the guidance criteria set up by the USFS Region, which state that “direct effects will be avoided by year-long exclusion of livestock from threatened and endangered species habitats” in order for an action to be “Not likely to adversely affect” the Gila chub. At least eight of the past consultations on native fish species in Arizona have recommended creating or extending riparian exclosures using riparian fencing as a method for reducing impacts of grazing on these species.

92. On some allotments that contain Gila chub habitat, riparian areas have already been excluded from grazing either year-round or seasonally. These reductions in grazing activity are likely to have impacted the ranchers that run cattle on those lands. In the past, the most frequent cause of riparian grazing exclusion in USFS Region 3 forests has been due to concerns for “general riparian health” and/or “protection of endangered riparian species.” 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 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.

93. 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 the Forest Service 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.

94. 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.
95. 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.
96. 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.⁷⁸
97. The result of this process was the exclusion of the majority of the riparian corridors on grazing allotments in USFS Region 3.⁷⁹ The Gila chub did not play a role in these reductions, since it was not yet proposed to be listed. Further, because only allotments on the Coronado National Forest have gone through a formal section 7 consultation related to Gila chub since proposed listing, few changes to grazing levels caused by the Gila chub can be documented to date.

5.4 Economic Impacts of Grazing Restrictions

98. The greatest economic impact of Gila chub conservation on livestock grazing activities would occur if restrictions on the use of riparian areas for livestock grazing are implemented, and reductions in the level of grazing activity occur (measured as a reduction in the number of permitted AUMs (animal unit months: forage for one cow and calf for one month) on an allotment). On Federal lands, AUM reductions would take the form of reductions in the number of authorized or permitted AUMs by USFS or BLM range managers. However, according to USFS and BLM staff, range managers can sometimes avoid AUM reductions when grazing restrictions are put in place through changes in grazing management practices. For example, managers frequently install off-river water sources for cattle, which allows grazing to continue. As noted above, the Service also states that alternative management, such as seasonal rest combined with grazing rotation, can serve to reduce impacts to Gila chub. Thus, for the purposes of this analysis, for allotments where

⁷⁸ United States District Court of Arizona. Southwest Center for Biological Diversity, et al., Plaintiffs v. United States Forest Service et al., Defendants, and Arizona Cattle Growers' Association, Applicant-in-Intervention. Forest Guardians, Plaintiff vs. United States Forest Service, et al., Defendants. No. CV 97-666 TUC JMR consolidated with No. CIV 97-2562 PHX-SMM.

⁷⁹ Personal communication, Wally Murphy, USFS Region 3, September 3, 2004.

proposed critical habitat is equal to less than five percent of total allotment area, this analysis assumes that changes in grazing management practices are available to avoid AUM reductions. This is consistent with assumptions used in the economic analysis of critical habitat designation for the Southwestern willow flycatcher. As shown in Exhibit 5-3, Gila chub CHD comprises less than five percent of the Federal grazing allotments that cross it.

Exhibit 5-3					
PERCENT OF GRAZING ALLOTMENTS IN GILA CHUB PROPOSED CHD AREAS					
Area	River Reach	Allotment	Total Allotment (Acres)	CHD Acres in Allotment	Percent
1	Eagle Creek	East Eagle	29,171	765	2.62%
	East Eagle Creek	Strayhorse	9,040	346	3.83%
2	Bonita Creek	Bonita Creek	29,665	742	2.50%
	Bonita Creek	Bullgap Community	8,875	116	1.30%
	Bonita Creek	Johnny Creek	23,789	222	0.93%
	Mineral Creek	Gov't Springs	8,370	397	4.75%
	Mineral Creek	Sleeping Beauty Mtn.	15,129	126	0.83%
4	Bass Canyon	Muleshoe	133,667	809	0.61%
	Redfield Canyon	C-Spear Ranch	5,998	185	3.08%
5	Cienega Creek - BLM	n/a	530,315	996	0.19%
	Cienega Creek - BLM	n/a	28,150	30	0.11%
	Sabino Canyon	n/a	69,939	407	0.58%
7	Indian Creek	Box Bar	12,474	117	0.94%
	Indian Creek	E-Z Ranch	8,911	71	0.80%
	Larry Creek	Horseshoe	137,868	426	0.31%
	Lousy Canyon	Cross-Y	19,582	33	0.17%

Source: BLM and Forest Service Allotment Summaries. GIS Data.

99. Gila chub conservation activities may also impact non-federal grazing activities to the extent that private landowners modify grazing practices in order to avoid incidental take under section 9.⁸⁰ Determining the economic impact to non-federal grazing activities first requires an estimate of the number of acres of non-federal grazing lands and a measure of the number of cattle that could be supported by these lands. This analysis finds that a small percentage of lands in the critical habitat area are likely to be used for private grazing. As was presented in Exhibit 4-1, eight groundwater wells in the critical habitat area are used for "stock" (livestock). Of these, three are maintained by Federal landowners. Of the remaining five wells, four are "exempt" wells, which pump less than 35 gallons per minute, and are therefore considered by the State of Arizona to constitute minor users that require less stringent regulation. The only non-exempt well that was registered by the State of Arizona

⁸⁰ It is worth noting that no consultations or HCPs currently exist that affect private grazing in Gila chub habitat areas. The Service questions the assumption that critical habitat designation will affect private grazing efforts in the future.

as being used for livestock use within the critical habitat designation is in O'Donnell Canyon, and is believed to be currently managed by the Nature Conservancy (and thus is not used for grazing activities). Because little private grazing activity occurs within the critical habitat area, this analysis does not estimate costs to private grazing activities that may result from Gila chub CHD.

5.5 Economic Impacts Related to Conservation Activities

100. As stated above, past consultations on grazing that addressed Gila chub are in keeping with the Service's position that even short-term grazing in habitat areas may adversely affect the Gila chub. Project modifications have primarily consisted of constructing and maintaining riparian exclusion fencing, but also have included alternative management activities, such as seasonal rest combined with grazing rotation, that served to reduce impacts to Gila chub and reduce the need for additional riparian fencing.⁸¹ To be conservative, this analysis assumes that landowners will implement the more costly measures of installing and maintaining riparian fencing. 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. This may result in an overestimate of future costs for some reaches.
101. Estimates for the past costs of these project changes are based on conversations with wildlife biologists, range management specialists, and permittees. Costs of fencing enclosures for Gila chub 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. 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.⁸² Over 20 years, these costs are estimated to be \$3,700 to \$66,800 (undiscounted dollars). BLM states that the agency usually funds fence construction, while maintenance programs may be shouldered by the permittees.⁸³ As stated above, 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.⁸⁴ Costs of creating off-river watering areas are estimated to cost \$2,000 to \$10,000, and are assumed to be required on every stream reach requires fence construction. Costs of species surveying and monitoring activities in grazed areas are presented in Section 8. Cost estimates of conservation activities on a per-unit basis (excluding species monitoring costs) are presented in Exhibit 5-4.

⁸¹ Written communication with Service, Arizona Ecological Services Office, July 1, 2005. For example, in the conference opinion issued for the Agua Fria National Monument, grazing rotation with seasonal rest combined with maintenance of existing fences, bank alteration limits, browsing limits, and herbaceous growth utilization limits were recommended in lieu of additional fencing Service, "Formal Conference Opinion on the Existing Phoenix Resource Management Plan for the Agua Fria National Monument," July 14, 2004.

⁸² Personal communication with Ted Cordery, BLM, Arizona State Office, July 18, 2005.

⁸³ Personal communication with Ted Cordery, BLM, Arizona State Office, July 18, 2005.

⁸⁴ Service, Partners for Wildlife, Arizona Ecological Services Office, July 15, 2005.

Exhibit 5-4			
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	
DRINKING WATER SOURCE (PER STREAM REACH)			
Source Construction*	\$2,000	\$10,000	5,7
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.			

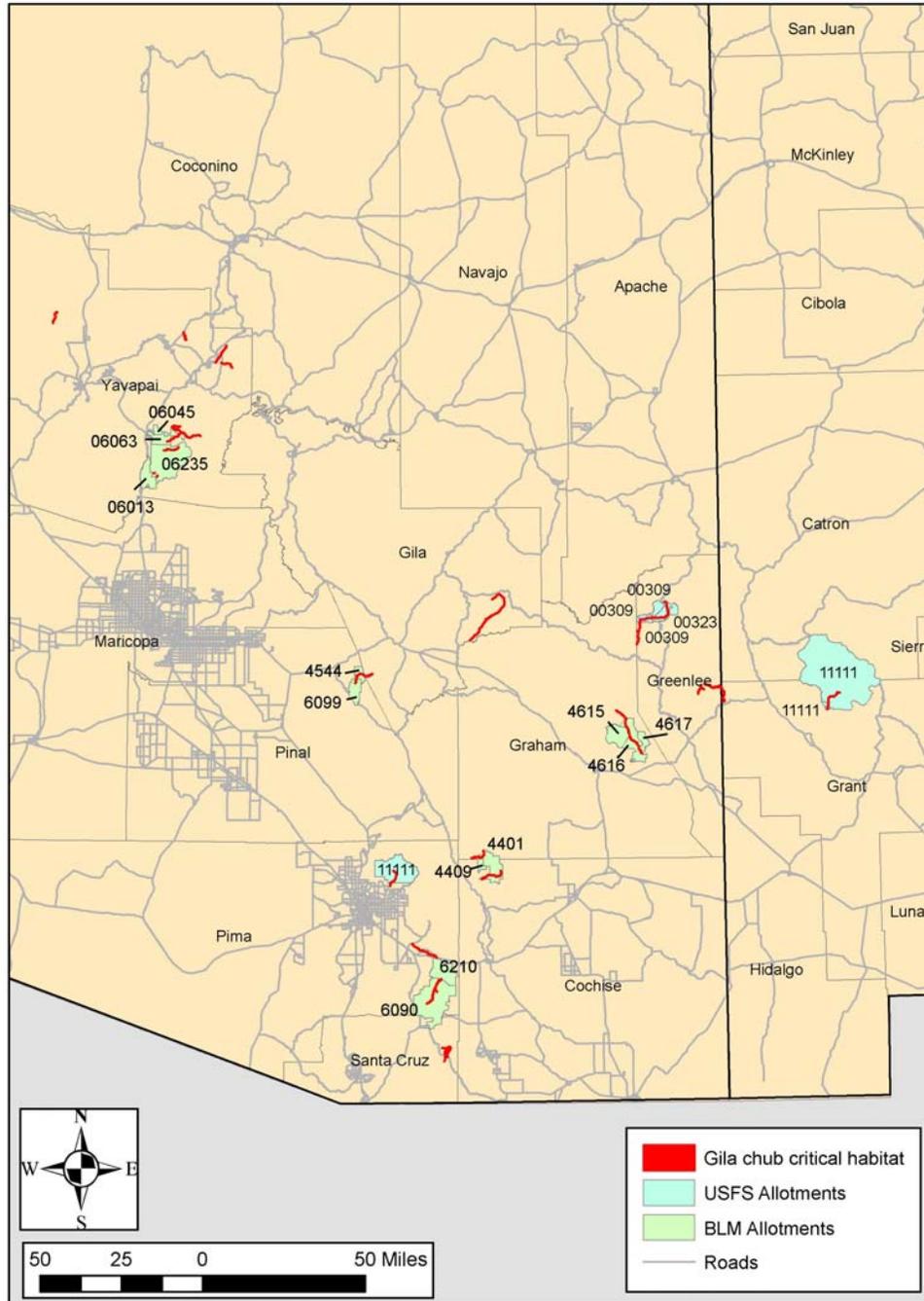
5.6 Economic Impacts of Gila Chub Conservation on Grazing Activities

102. This section discusses the future impacts of Gila chub conservation activities on USFS, BLM, and non-federal lands by looking at costs of Gila chub conservation activities. The following sections provide summaries of past and future Gila chub conservation activities and the status of grazing within the riparian corridor on grazing lands by CHD area and stream reach. Exhibit 5-5 presents the geographic locations of grazing allotments, as defined by GIS data.⁸⁵ Finally, Exhibit 5-6 presents the costs of future Gila chub conservation activities by stream reach.

⁸⁵ Note that a few allotments were identified through personal communications that did not appear in the GIS data. In these cases, the personal communications were used and potential impacts quantified.

Exhibit 5-5

GEOGRAPHIC LOCATIONS OF FEDERAL GRAZING ALLOTMENTS THAT INTERSECT PROPOSED GILA CHUB CHD



Area 1: Upper Gila River Area

- **Dix Creek:** Dix Creek is inside Apache-Sitgreaves National Forest. There is currently some grazing taking place on this land, however, since the grazing taking place does not comply with current Pleasant Valley Management Plan requirements, steps are currently being taken in order to either discontinue grazing or to bring grazing into compliance (including installing fences along 0.6 river miles within the proposed CHD area).⁸⁶ Nonetheless, this analysis assumes that future riparian fencing costs will be attributable to Gila chub conservation.
- **Harden Cienega Creek:** Harden Cienega Creek stream reach crosses from Apache-Sitgreaves National Forest into Gila National Forest. The Harden Cienega Allotment is located in this area and grazing currently occurs there.⁸⁷ This analysis assumes that future fencing (along 8.1 river miles) and other conservation activities will occur on this creek and are attributable to Gila chub conservation.
- **Eagle Creek and East Eagle Creek:** The East Eagle and Strayhorse allotments are both USFS grazing allotments located within the Eagle and East Eagle proposed CHD stream reach. Approximately three percent (765 acres) of the East Eagle allotment falls within the Eagle Creek and East Eagle Creek stream reaches of proposed Gila chub CHD. Approximately four percent (346 acres) of the Strayhorse allotment on Apache-Sitgreaves National Forest falls in the East Eagle Creek reach of Gila chub CHD. The USFS states that these are active allotments. This analysis estimates that about 16 river miles in these allotments will need to be fenced for Gila chub concerns.

The stream reach within Eagle Creek that overlaps with the Eagle Creek Allotment has about 1.3 river miles that may require fencing to protect Gila chub and its habitat. The stream reach within East Eagle Creek overlaps with both the East Eagle and the Strayhorse Allotments and will require fencing along about 4.8 and 9.3 river miles, respectively (both sides of the river). This analysis assumes that this fencing and maintenance will occur in the future, and are costs that will be attributable to Gila chub conservation.

- **Turkey Creek (New Mexico):** Turkey Creek in New Mexico falls in the Gila Wilderness. Grazing is not allowed in the Turkey Creek stream reach based on the 1986 National Forest Plan, so this analysis assumes that no fencing will be needed resulting from Gila chub conservation activities.⁸⁸

Area 2: Middle Gila Area

- **Mineral Creek:** The proposed CHD stream reach of Mineral Creek includes state lands, private lands, BLM lands, as well as lands in the Tonto National Forest. Approximately 0.8 percent of BLM's Sleeping Beauty Mountain allotment crosses the 300 foot boundary of

⁸⁶ Personal communication with Kent Ellett of the Apache-Sitgreaves National Forest. June 20, 2005.

⁸⁷ Personal communication with Jerry Monzingo of the Gila National Forest. June 21, 2005.

⁸⁸ Written communication from Jerry Monzingo, Fisheries Biologist, Gila National Forest, May 13, 2005.

CHD (126 acres), but this allotment does not cross the river itself. BLM reports that 120 AUMs are grazed on this allotment, and no grazing occurs in the proposed CHD area.⁸⁹ This analysis nonetheless assumes that riparian fencing may be required to ensure no trespass by cattle.

BLM's Government Springs allotment also crosses the proposed CHD, which is only lightly grazed at 24 AUMs. Approximately 397 acres, or 4.8 percent of the Government Springs allotment falls within the proposed CHD, but BLM reports that no grazing occurs in this area.⁹⁰ Grazing is also permitted along the stretch of river in the Tonto National Forest.⁹¹ This analysis assumes that riparian fencing may be required to ensure no trespass by cattle to both of these areas. Private lands along the proposed CHD stretch of Mineral Creek are owned by mining interests.

Mineral Creek grazing activities are anticipated to require a total of about seven river miles of riparian fencing to protect Gila chub and its habitat (on both sides of the river).

- **Blue River:** The Blue River stream reach falls entirely on lands owned by the San Carlos Apache Tribe. The Tribe grazes between 2,500 and 3,000 head on two large allotments that include this reach. Potential impacts on grazing activities associated with the San Carlos Apache are described in detail in Section 6.
- **Bonita Creek:** Three grazing allotments permitted by BLM fall on the Bonita Creek stream reach of proposed CHD for the Gila chub. Approximately 1,080 acres across the three allotments are proposed as critical habitat for the Gila chub, comprising approximately two percent of the acreage in the allotments. The area of the allotment that falls within proposed CHD is less than five percent, therefore, this analysis does not anticipate reductions in grazing associated with the Bonita Creek stream reach. These BLM lands along Bonita Creek were fenced in the early 1990's to exclude livestock in order protect riparian habitat, and to protect the drinking water sources for the City of Safford. Thus, this analysis assumes that no fencing construction costs will be required for Gila chub, though future maintenance of the fencing could be required for Gila chub conservation.

The San Carlos Apache lands along Bonita Creek have some grazing activities. The Tribe is currently looking at alternatives to traditional fencing methods to keep cattle out of the creek bed. Potential impacts of Gila chub conservation activities on the San Carlos Apache grazing activities are detailed in Section 6.

Area 3: Babocomari River Area

- **O'Donnell Canyon:** One non-exempt well is registered to a private users as using water for livestock within this stream reach. However, because this reach is managed by the Nature Conservancy (TNC) as a nature preserve, this area has not been grazed since Gila chub was

⁸⁹ Written communication with Ted Cordery, Arizona State Office, BLM, on July 20, 2005.

⁹⁰ Written communication with Ted Cordery, Arizona State Office, BLM, on July 20, 2005.

⁹¹ Personal communication with Buck McKinney, Grazing Specialist, Tonto National Forest, June 21, 2005.

proposed to be listed. A fire in 2001 damaged the fence that kept livestock out of the area. The 2002 consultation on grazing with Coronado National Forest that included the Gila chub addressed the need to fix this fence.⁹² This analysis assumes that future fence maintenance costs are attributable to Gila chub conservation activities.

- No grazing occurs within the other stream reaches within the Babocomari River Area.⁹³

Area 4: Lower San Pedro River Area

- **Redfield Canyon:** Two grazing allotments permitted by BLM fall on the Redfield Canyon stream reach of proposed CHD for the Gila chub. Currently limited grazing occurs on the C-Spear grazing allotment (60 AUMs), though BLM reports that grazing does not occur in the proposed CHD area.⁹⁴ Approximately three percent (185 acres) of the C-Spear Ranch allotment is within the proposed CHD for the Gila chub. Grazing does not occur on BLM's Muleshoe allotment, as this allotment is managed by TNC for wildlife.⁹⁵ This analysis assumes that 0.9 river miles on the C-Spear Ranch allotment will need to be fenced for Gila chub conservation.
- **Bass Canyon:** One grazing allotment permitted by BLM falls within the Bass Canyon stream reach of proposed CHD for the Gila chub. The Muleshoe allotment is managed by TNC for wildlife and does not currently allow grazing. Since grazing is not permitted, no fencing is required in this area to protect Gila chub and its habitat.
- **Hot Spring Canyon:** One grazing allotment permitted by BLM falls within the Hot Spring Canyon stream reach of proposed CHD for the Gila chub. Grazing does not occur on the Muleshoe allotment, so no fencing is required. This allotment is managed by TNC for wildlife.

Area 5, Lower Santa Cruz River Area

- **Cienega Creek:** There are two large BLM allotments on Cienega Creek stream reach that are grazed with approximately 8,500 AUMs each. BLM reports that parts of the proposed CHD areas are occasionally grazed by cattle.⁹⁶ The approximate acreage of the two allotments that fall within the boundaries of critical habitat is 609 acres. These 609 acres account for approximately 0.6 percent of the total acres in the allotments. This analysis assumes that Cienega Creek has a total of about 8.5 river miles that may require fencing to protect the Gila chub and its habitat.
- **Mattie Canyon:** There is one BLM allotment on the Mattie Creek stream reach. Approximately 178 acres of this allotment fall within the boundaries of critical habitat.

⁹² Personal communication with Tom Skinner, Wildlife Program Manager, Coronado NF, May 26, 2005.

⁹³ *Ibid.*

⁹⁴ Written communication with Ted Cordery, Arizona State Office, BLM, on July 20, 2005.

⁹⁵ Written communication with Ted Cordery, Arizona State Office, BLM, on July 20, 2005.

⁹⁶ Written communication with Ted Cordery, Arizona State Office, BLM, on July 20, 2005.

These 178 acres account for approximately 0.2 percent of the allotment. This analysis assumes that Mattie Creek has a total of about 2.5 river miles that may require fencing to protect the Gila chub and its habitat.

- **Empire Gulch:** There is one BLM allotment on the Empire Gulch stream reach. Approximately 240 acres of this allotment fall within the boundaries of critical habitat. These 240 acres account for approximately 0.3 percent of the allotment. Empire Gulch stretches across part of an allotment and has a total of about 3.2 river miles that may require fencing to protect the Gila chub and its habitat.
- **Sabino Canyon:** There is USFS allotment on the Sabino Canyon stream reach. Approximately 406 acres of this allotment fall within the boundaries of critical habitat. These acres account for approximately 0.6 percent of the allotment. This analysis assumes that Sabino Canyon has a total of about 5.7 river miles that may require fencing to protect the Gila chub and its habitat.

Area 6: Upper Verde River Area

- **Walker Creek:** USFS reports that two allotments cross the Gila chub proposed CHD. These are Beaver Creek allotment, which is fenced, but contains a 267-foot water gap, and Walker Basin Allotment, which contains a 350-foot water gap. The USFS reports that the water gaps are heavily used by cattle.⁹⁷ Private lands on Walker Creek are used by a large ranching operation with water rights. This analysis assumes that the gap will need to be fenced to exclude cattle to accommodate Gila chub concerns, and that an off river water source will need to be created.
- **Red Tank Draw.** The USFS allotment Beaver Creek also crosses this reach of proposed CHD.⁹⁸ There are a total of about six river miles that may require fencing to protect the Gila chub and its habitat.
- **Spring Creek:** The Coconino National Forest lands on the Spring Creek portion of proposed CHD have been fenced to exclude livestock since prior to 1991.⁹⁹ Private lands on this stretch have a few horses, but are not heavily grazed. This analysis does not assume that future fencing costs are attributable to Gila chub conservation.

Area 7: Agua Fria River Area

- **Sycamore/Little Sycamore:** The USFS reports that the livestock are essentially excluded from the Little Sycamore stream reach as the forest is fenced at the Prescott National Forest property line.¹⁰⁰ Thus this analysis assumes that no fencing will be required to be

⁹⁷ Personal communication with Janie Agyagnos, Wildlife Biologist, Coconino National Forest on May 17, 2005.

⁹⁸ *Ibid.*, May 17, 2005.

⁹⁹ *Ibid.*, May 17, 2005.

¹⁰⁰ Personal communication with Albert Sillas, Fisheries Biologist, Prescott National Forest on May 16, 2005.

constructed for Gila chub. However, future fence maintenance costs are assumed be required to accommodate Gila chub.

- **Indian Creek:** There are two BLM grazing allotments within the Indian Creek stream reach. Approximately 0.9 percent of the Box Bar allotment (117 acres) crosses proposed CHD. BLM reports that 2,400 AUMs are grazed on the allotment, and that livestock currently graze in proposed CHD areas.¹⁰¹ Grazing is restricted to winter use only under BLM's Standards of Rangeland Health.¹⁰² The E-Z Ranch allotment has approximately 71 acres that fall within the geographic area proposed for CHD. These acres represent 0.8 percent of the total E-Z Ranch allotment, which supports 972 AUMs in total. Similar to Box Bar, BLM reports that livestock currently graze on proposed CHD areas.¹⁰³ This analysis assumes that a total of about 1.5 river miles that may require fencing to protect the Gila chub and its habitat. Prescott National Forest lands have been fenced off since 2003 with off-stream water diversions for cattle. This analysis assumes that future fence maintenance costs are attributable to Gila chub CHD.
- **Silver Creek:** There is one BLM grazing allotment within the Silver Creek stream reach. The Horseshoe allotment has approximately 388 acres within proposed CHD, which accounts for 0.6 percent of the acreage in the Horseshoe allotment. This allotment supports approximately 4,600 AUMs of grazing effort. The BLM reports grazing currently occurs in proposed CHD areas on this allotment.¹⁰⁴ The Agua Fria Resource Management Plan conference opinion noted that of the two affected pastures in the Horseshoe allotment, Boone Pasture is grazed in the winter in a rest-rotation system, and cattle trail through Silver Pasture for approximately 10 days per year.¹⁰⁵ Silver Creek stretches through part of the Horseshoe allotment and has a total of about four river miles that may require fencing to protect the Gila chub and its habitat.
- **Larry Creek:** There is one BLM grazing allotment within the Larry Creek stream reach. The Larry Creek stream reach is completely within the Cross Y allotment. Approximately 33 acres, or 0.2 percent of the BLM allotment called Cross Y is included as proposed CHD for the Gila chub. Larry Creek stretches through part of the Horseshoe allotment and has a total of about 0.4 river miles that may require fencing to protect the Gila chub and its habitat.

¹⁰¹ Written communication with Ted Cordery, Arizona State Office, BLM, on July 20, 2005.

¹⁰² Service, "Formal Conference Opinion on the Existing Phoenix Resource Management Plan for the Agua Fria National Monument," July 14, 2004.

¹⁰³ Written communication with Ted Cordery, Arizona State Office, BLM, on July 20, 2005.

¹⁰⁴ Written communication with Ted Cordery, Arizona State Office, BLM, on July 20, 2005.

¹⁰⁵ Service, "Formal Conference Opinion on the Existing Phoenix Resource Management Plan for the Agua Fria National Monument," July 14, 2004.

- **Lousy Canyon:** The very short Lousy Canyon stream reach is completely within BLM's Horseshoe allotment, which supports 2,800 AUMs of grazing effort.¹⁰⁶ However, the conference opinion on the Agua Fria National Monument notes that the stream reach is inaccessible to cattle due to steep topography, though cattle graze the uplands in that area.¹⁰⁷ Approximately 425 acres, or 0.3 percent of the Horseshoe allotment on BLM lands crosses Gila chub CHD. A total of about 0.2 river miles are estimated to require fencing to protect the Gila chub and its habitat.

¹⁰⁶ Written communication with Ted Cordery, Arizona State Office, BLM, on July 20, 2005.

¹⁰⁷ Service, "Formal Conference Opinion on the Existing Phoenix Resource Management Plan for the Agua Fria National Monument," July 14, 2004.

Exhibit 5-6

**DETAILED SUMMARY OF FUTURE COST RELATED TO GRAZING ACTIVITIES FOR THE GILA CHUB
(2005-2024, undiscounted dollars)**

Area	SubUnit Name	Allotment Name	CHD Stream Reach Length (rm)	% CHD that is Grazed	River Miles Needing Fencing	Fence Construction (Low) /1	Fence Construction (High) /1	Total Other Costs (Low) /6	Total Other Costs (High)/6	TOTAL COST (Low)	TOTAL COST (High)
1	Dix Creek	Pleasant Valley	0.6	100%	0.6	\$1,800	\$18,000	\$9,800	\$70,700	\$11,600	\$88,700
	Eagle Creek	East Eagle	10.4	12%	1.3	\$3,800	\$38,100	\$9,800	\$70,700	\$13,600	\$108,800
	East Eagle Creek	East Eagle	14.0	66%	9.3	\$27,800	\$277,900	\$9,800	\$70,700	\$37,600	\$348,600
	East Eagle Creek	Strayhorse	14.0	34%	4.8	\$14,300	\$143,000	\$9,800	\$70,700	\$24,100	\$213,700
	Turkey Creek	n/a	7.3	0%	0.0	\$0	\$0	\$0	\$0	\$0	\$0
	Harden Cienega Creek	Harden Cienega	14.4	56%	8.1	\$24,200	\$241,900	\$9,800	\$70,700	\$34,000	\$312,600
	Subtotal				24.0	\$71,900	\$718,900	\$49,000	\$353,500	\$120,900	\$1,072,400
2	Bonita Creek /2	Bonita Creek	16.4	54%	0.0	\$0	\$0	\$6,800	\$59,200	\$6,800	\$59,200
	Bonita Creek /2	Bullgap Community	16.4	8%	0.0	\$0	\$0	\$6,800	\$59,200	\$6,800	\$59,200
	Bonita Creek /2	Johnny Creek	16.4	16%	0.0	\$0	\$0	\$6,800	\$59,200	\$6,800	\$59,200
	Mineral Creek	Gov't Springs	9.0	61%	5.5	\$16,400	\$163,800	\$8,800	\$69,200	\$25,200	\$233,000
	Mineral Creek	Sleeping Beauty Mtn.	9.0	19%	1.7	\$5,200	\$52,000	\$8,800	\$69,200	\$14,000	\$121,200
	Blue River /7	San Carlos Apache Tribe	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Subtotal				7.2	\$21,600	\$215,800	\$38,000	\$316,000	\$59,600	\$531,800
3	O'Donnell Canyon	n/a	6.2	0.0	0.0	\$0	\$0	\$2,180	\$51,760	\$2,200	\$51,800
	Subtotal				0.0	\$0	\$0	\$2,180	\$51,760	\$2,200	\$51,800
4	Bass Canyon /3	Muleshoe	3.4	100%	0.0	\$0	\$0	\$5,600	\$8,900	\$5,600	\$8,900
	Hot Springs Canyon /3	Muleshoe	0.7	95%	0.0	\$0	\$0	\$5,600	\$8,900	\$5,600	\$8,900
	Redfield Canyon	C-Spear Ranch	7.2	12%	0.9	\$2,700	\$26,800	\$9,800	\$70,700	\$12,500	\$97,500

Exhibit 5-6

**DETAILED SUMMARY OF FUTURE COST RELATED TO GRAZING ACTIVITIES FOR THE GILA CHUB
(2005-2024, undiscounted dollars)**

Area	SubUnit Name	Allotment Name	CHD Stream Reach Length (rm)	% CHD that is Grazed	River Miles Needing Fencing	Fence Construction (Low) /1	Fence Construction (High) /1	Total Other Costs (Low) /6	Total Other Costs (High)/6	TOTAL COST (Low)	TOTAL COST (High)
	Redfield Canyon /3	Muleshoe	7.2	12%	0.0	\$0	\$0	\$5,600	\$8,900	\$5,600	\$8,900
	Subtotal				0.9	\$2,700	\$26,800	\$26,600	\$97,400	\$29,300	\$124,200
5	Cienega Creek	n/a	8.4	5%	0.4	\$1,300	\$12,600	\$9,800	\$70,700	\$11,100	\$83,300
	Cienega Creek	n/a	8.4	95%	8.0	\$24,000	\$240,200	\$9,800	\$70,700	\$33,800	\$310,900
	Empire Gulch	n/a	3.2	100%	3.2	\$9,700	\$97,100	\$9,800	\$70,700	\$19,500	\$167,800
	Mattie Canyon	n/a	2.5	100%	2.5	\$7,400	\$74,200	\$9,800	\$70,700	\$17,200	\$144,900
	Sabino Canyon	n/a	6.9	82%	5.7	\$17,000	\$169,700	\$9,800	\$70,700	\$26,800	\$240,400
	Subtotal				19.8	\$59,400	\$593,800	\$49,000	\$353,500	\$108,400	\$947,300
6	Walker Creek /4	Beaver Creek	4.7	79%	0.1	\$100	\$800	\$11,200	\$73,000	\$11,300	\$73,800
	Walker Creek /5	Walker Basin	4.7	79%	0.1	\$100	\$1,000	\$11,200	\$73,000	\$11,300	\$74,000
	Red Tank Draw	Beaver Creek	6.9	86%	6.0	\$17,900	\$178,600	\$11,200	\$73,000	\$29,100	\$251,600
	Spring Creek /2	n/a	3.6	46%	0.0	\$0	\$0	\$9,200	\$63,000	\$9,200	\$63,000
	Subtotal				6.1	\$18,100	\$180,400	\$42,800	\$282,000	\$60,900	\$462,400
7	Indian Creek	Box Bar	3.3	30%	1.0	\$3,000	\$29,800	\$8,800	\$69,200	\$11,800	\$99,000
	Indian Creek	E-Z Rance	3.3	19%	0.6	\$1,800	\$18,200	\$8,800	\$69,200	\$10,600	\$87,400
	Larry Creek	Cross Y	0.4	100%	0.4	\$1,300	\$13,000	\$8,800	\$69,200	\$10,100	\$82,200
	Little Sycamore /2	n/a	2.9	n/a	0.0	\$0	\$0	\$6,800	\$59,200	\$6,800	\$59,200
	Lousy Canyon	Horseshoe	0.2	100%	0.2	\$500	\$5,000	\$8,800	\$69,200	\$9,300	\$74,200
	Silver Creek	Horseshoe	4.1	100%	4.1	\$12,200	\$122,400	\$8,800	\$69,200	\$21,000	\$191,600
	Subtotal				6.3	\$18,800	\$188,400	\$50,800	\$405,200	\$69,600	\$593,600
	TOTAL				64.2	\$192,500	\$1,924,100	\$256,200	\$1,807,600	\$450,900	\$3,783,500

Exhibit 5-6

**DETAILED SUMMARY OF FUTURE COST RELATED TO GRAZING ACTIVITIES FOR THE GILA CHUB
(2005-2024, undiscounted dollars)**

Area	SubUnit Name	Allotment Name	CHD Stream Reach Length (rm)	% CHD that is Grazed	River Miles Needing Fencing	Fence Construction (Low) /1	Fence Construction (High) /1	Total Other Costs (Low) /6	Total Other Costs (High)/6	TOTAL COST (Low)	TOTAL COST (High)
<p>1/ Assumes that fence construction will be required on both sides of river/stream. Assumes that fence construction will be required on both sides of river/stream. 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 Gila chub and reduce the need for additional riparian fencing. Written communication with Service, Arizona Ecological Services Office, July 1, 2005. To be conservative, this analysis assumes that landowners will implement the more costly measures of installing and maintaining riparian fencing. This may result in an overestimate of future costs for some reaches.</p> <p>2/3/ Stream reach currently has riparian fencing, but is assumed to require fence maintenance.</p> <p>4/ This area current is fenced with a 267 foot water gap. This analysis assumes that a fence of this length is required in combination with an off-river water source.</p> <p>5/ fenced with a 350 foot water gap This analysis assumes that a fence of this length is required in combination with an off-river water source.</p> <p>6/ Other costs include, when appropriate, all or some of: Administrative Costs (discussed in Appendix A), Fence Maintenance, Species Monitoring, Alternative Water Sources and maintenance.</p> <p>7/ See Section 6 for costs to the San Carlos Apache Tribe.</p> <p>Assumptions: This table assumes that administrative costs for one consultation is incurred in each Area once every ten years. Administrative costs are estimated at a low and high of \$13,900 and \$22,300, respectively. Fence maintenance costs are estimated at \$2,180 to \$51,760 per mile over 20 years. Assumes that one water source will be constructed in each reach where fence construction is assumed. Construction and maintenance of alternative watering source costs of over twenty years are estimated at \$8,668 to \$20,000.</p>											

103. As described in Section 2 of this analysis, a portion of the Middle Gila River area of the proposed critical habitat for the Gila chub falls within the San Carlos Apache reservation. This section provides an analysis of economic impacts associated with Gila chub conservation activities on the Tribal lands as presented in Exhibit 6-1. The administrative costs associated with section 7 consultation for activities occurring on Tribal lands are discussed in Section 3 of the report, while impacts related to surveying and monitoring efforts funded by the Tribe, and project modifications associated with Tribal activities are discussed in this section.

Exhibit 6-1		
TRIBAL LANDS OVERLAPPING PROPOSED CHD FOR THE GILA CHUB		
Area	Stream Reach	Tribal Lands
Area 2: Middle Gila River	Blue River	San Carlos Apache
	Bonita Creek	San Carlos Apache

104. The San Carlos Apache Tribe is a sovereign nation. 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 Tribe has its own natural resource program and staff, and has enacted or is in the process of developing several resource management plans. 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.

105. 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 Gila chub critical habitat areas.¹⁰⁸ Information was gathered for this analysis during a meeting and through several phone conversations with Tribal and BIA representatives.

106. This analysis provides current socioeconomic data underscoring the conditions on the San Carlos Apache reservation. Available data demonstrate the economic vulnerability of the Tribe; its economy is 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 Gila chub conservation impacts job availability on the reservation, those impacts may be compounded by poor baseline economic conditions.

107. Where information is available, the overall contribution of potentially affected activities is discussed to provide an upper bound estimate of potential impacts resulting from Gila chub conservation activities. For example, the San Carlos Apache currently operate sawmills. To the extent that information on these operations was made available by the Tribe, the information is presented in this section.

6.1 Background

108. The San Carlos Apache Reservation encompasses over 1.8 million acres in southeast Arizona. As shown in Exhibit 6-2, the Service has proposed for designation the entire 25-mile length of the Blue River, all of which flows on reservation land, and 39.6 miles of Bonita Creek, of which approximately the uppermost 12 miles flows on reservation land.¹⁰⁹ In considering the Service's 300-foot buffer on either side of proposed critical habitat, approximately 2,691 acres of San Carlos Apache land are included in the proposed Gila chub critical habitat designation: 1,818 acres along Blue River and 873 acres along Bonita Creek. The following discussion provides background information on the San Carlos Apache and estimates impacts on the San Carlos Apache due to Gila chub conservation efforts.

¹⁰⁸ 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 *Salix Arizona* (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.

¹⁰⁹ Personal communication with Loretta Stone, Environmental Programs Specialist, San Carlos Apache EPA, June 8, 2005.

Exhibit 6-2

PROPOSED CRITICAL HABITAT FOR THE GILA CHUB ON THE
SAN CARLOS APACHE RESERVATION



San Carlos Apache Socioeconomic Status

109. Exhibit 6-3 summarizes basic socioeconomic information for the San Carlos Apache Tribe. Based on U.S. Census data, the Tribe's population was 9,385 in 2000; current population is estimated at more than 12,000.¹¹⁰ Based on the 2000 Census, the unemployment rate was 35.4 percent. However, a recent study by the Tribe found that the unemployment rate is much higher, at 76 percent, indicating that at least seven out of ten people in the Tribe's labor force were unemployed.¹¹¹ 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.

Exhibit 6-3				
2000 SOCIOECONOMIC INFORMATION – SAN CARLOS APACHE TRIBE				
Area/Tribal Lands	Population	Unemployment Rate ⁽¹⁾	Per Capita Income	Poverty Rate ⁽²⁾
<i>National Level Information</i>				
USA	281,421,906	4.2%	\$21,587	12.4%
<i>State Level Information</i>				
Arizona	5,130,632	5.6%	\$20,275	13.9%
<i>County Level Information ⁽³⁾</i>				
Gila County	51,335	4.8%	\$16,315	17.4%
Graham County	33,489	5.7%	\$12,139	23.0%
Pinal County	179,727	3.9%	\$16,025	16.9%
<i>Tribal Level Information</i>				
San Carlos Apache	9,385	35.4% ⁽⁴⁾	\$5,200	48.2%
Notes:				
(1) County level unemployment rate represents the percentage of unemployed people out of all people over the age of 18, not a percentage of the workforce.				
(2) Poverty rate represents the percentage 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 .				
(3) Although the Tribe's reservation overlaps with Gila, Graham, and Pinal counties, the Blue River is entirely in Gila County and Bonita Creek entirely in Graham County.				
(4) 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.				
Sources: 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 .				

¹¹⁰ 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.

¹¹¹ 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.

110. 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.

6.2 San Carlos Apache Activities Potentially Impacted by Gila Chub Conservation

111. Based on consultation records and conversations with the Service, BIA and Tribal staff, past and potential ongoing impacts to San Carlos Apache activities related to Gila chub conservation efforts include the following:

- Administrative costs of complying with the Act and preparing a Fisheries Management Plan;
- Limitations on livestock use of proposed CHD for grazing and water;
- Limitations on timber harvest;
- Limitations on recreational opportunities; and
- Limitations on fire management activities.

Each of these impacts is discussed in more detail below.

Administrative Costs

112. Costs of Gila chub conservation activities to date are limited to the development of a Draft Fisheries Management Plan in 2003 and related surveying and monitoring of the Tribe's water resources, including Blue River and Bonita Creek. The San Carlos Apache Tribe has not consulted formally or informally with the Service with regard to the Gila chub, nor has the Tribe implemented any project modifications for the Gila chub. The cost of this fisheries surveying and development of the Draft Fisheries Management Plan are considered past impacts related to Gila chub conservation activities, although specific cost estimates are unavailable.
113. Any future consultations with the Service would involve a commitment of the Tribe's limited resources. The Tribe is unsure how the critical habitat designation would affect their future administrative efforts, particularly in light of the Tribe's recent efforts related to the development of the Fisheries Management Plan. The Tribe is also unsure of the costs of developing and implementing the Final Fisheries Management Plan.¹¹² Furthermore, if the Final Fisheries Management Plan does not adequately address

¹¹² Personal communication with Stefanie White, San Carlos Apache Recreation and Wildlife Department, May 25 and June 6, 2005.

conservation of the Gila chub, designation of Blue River and Bonita Creek as critical habitat could result in significant additional administrative effort to address the species and its critical habitat in biological evaluations. On the other hand, if the Fisheries Management Plan adequately addresses conservation of the Gila chub, the critical habitat designation would result in little extra administrative effort. Costs associated with species and habitat management – primarily surveying and monitoring – are discussed in Section 8.

114. The Tribe has also recently drafted a Forest Management Plan and a Fire Management Plan. Although neither of these currently addresses the Gila chub, they could be revised in the future to include Gila chub conservation measures.

Livestock Grazing

115. 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. Tribal representatives have expressed concerns that grazing could be impacted by this designation. All 2,691 acres of proposed Gila chub critical habitat overlap with land that is grazed: along the Blue River, land is leased to the Ash Creek and Anchor Seven livestock associations with approximately 3,000 cattle combined; along Bonita Creek, land is leased to Slaughter Mountain Livestock Association with approximately 1,000 cattle and horses.¹¹³

116. It is unknown what modifications or mitigation measures may be recommended to grazing activities as a result of Gila chub concerns. If the Service recommended or the Tribe chose to implement mitigation measures, one option could be the installation of fencing along the Blue River and Bonita Creek to exclude livestock from the streams and adjacent riparian areas.¹¹⁴ Exhibit 5-4 summarizes unit costs and sources related to fencing. Costs of fencing exclosures for Gila chub are anticipated to range from \$1,500 to \$15,000 per river mile of fence construction. Assuming that fencing would be installed on both sides of the stream reaches, the total cost to install 74 miles of fencing (50 miles along the Blue River, 24 miles along Bonita Creek) is between \$111,000 and \$1,110,000. The Tribe would also incur costs related to annual maintenance of the fencing. Based on per mile costs ranging between \$110 and \$2,600, the annual cost to maintain fencing is between \$8,100 and \$192,400. In addition, if fencing were installed, water would need to be provided to livestock outside the exclosure.¹¹⁵ This analysis assumes one off-river water source would need to be constructed and maintained every

¹¹³ Personal communication with San Carlos Apache and livestock association personnel, May 25, 2005; personal communication with San Carlos Apache personnel, June 16, 2005.

¹¹⁴ According to Service personnel, however, the need for installation of fencing and additional off-river water sources is unlikely, primarily because the Service believes the Gila chub populations in the Blue River are doing well and have historically coexisted with livestock. Written communication with Service, Arizona Ecological Services Office, July 1, 2005.

¹¹⁵ According to Loretta Stone, Environmental Programs Specialist at the San Carlos Apache EPA, water is already provided upland of Bonita Creek to prevent livestock from entering the streambed (personal communication, June 8, 2005). Nevertheless, this analysis quantifies the cost of providing water near Bonita Creek as an economic impact related to Gila chub conservation activities.

12 miles on both sides of the streams, or six in all. The cost to construct a dirt impoundment to store overland flow ranges between \$2,000 and \$10,000, for a total cost to construct off-river water sources of between \$12,000 and \$60,000. The annual cost to maintain dirt impoundments ranges between \$333 and \$500, for a total cost to maintain off-river water sources of between \$2,000 and \$3,000.¹¹⁶ Exhibit 6-4 summarizes potential future costs to livestock activities from Gila chub conservation measures.

117. 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 lands, Federal landowners frequently bear the costs of constructing riparian fencing, while maintenance costs may be borne by permittees.¹¹⁷
118. Despite the potential impacts on livestock activities, the value of the lost grazing area as a result of Gila chub conservation activities does not contribute significantly to economic impacts. This is due to the unlikelihood that there will be much change in grazing effort on the San Carlos Apache Reservation, primarily because: (1) the area of proposed critical habitat is such 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.

Timber Harvesting

119. The San Carlos Apache Tribe has approximately 55,120 acres of accessible commercial timberland.¹¹⁸ Less than one percent of commercial timberland is proposed critical habitat for the Gila chub, and the overlap occurs exclusively along the upper one-third of the Blue River. However, the Gila chub CHD could potentially impact the Tribe's timber harvesting activity in these areas.
120. Under its current forest management approach, the Tribe does not conduct timber operations within a 66-foot buffer area from the banks of waterways. Extending this restriction on timber operations to the full 300-foot width of proposed critical habitat removes an additional 473 acres of forests from expected commercial timber operations. The calculation of the economic impact associated with the removal of 473 acres from timber operations includes estimating the lost annual timber revenue from that area and is illustrated in Exhibit 6-5. The following assumptions are used in this calculation:

¹¹⁶ *Ibid.*

¹¹⁷ Personal communication with Ted Cordery, BLM, Arizona State Office, July 18, 2005.

¹¹⁸ 2001 Catalog of Forest Acres. Compiled by USDI, Bureau of Indian Affairs, Division of Forestry, Branch of Forest Resources Planning. September 30, 2001.

Exhibit 6-4

COST ESTIMATES FOR FENCING-RELATED CONSERVATION ACTIVITIES ON SAN CARLOS APACHE LAND

Area	Stream Reach	Fence Construction	Annual Fence Maintenance	Off-River Water Source Construction	Off-River Water Source Annual Maintenance	Total Cost (undiscounted dollars)	Total Cost (3% discount)	Total Cost (7% discount)
2	Blue River	\$75,000-\$750,000	\$5,500-\$130,000	\$8,000-\$40,000	\$1,300-\$2,000	\$219,000 - \$3,430,000	\$184,200 - \$2,753,800	\$155,000 - \$2,188,400
	Bonita Creek	\$36,000-\$360,000	\$2,600-\$62,400	\$4,000-\$20,000	\$700-\$1,000	\$106,000 - \$1,648,000	\$89,100 - \$1,323,200	\$75,000 - \$1,051,700
	Total	\$111,000-\$1,110,000	\$8,100-\$192,400	\$12,000-\$60,000	\$2,000-\$3,000	\$325,000 - \$5,078,000	\$273,300 - \$4,076,000	\$230,000 - \$3,240,100

- To convert total impacted acreage to potential annual reduction in timber harvest:
 - ▶ Timber would be harvested sustainably, using uneven age management, assuming a 30 year rotation (e.g., total potentially impacted acreage is divided by 30);¹¹⁹ and
 - ▶ For every acre of timberland, timber harvest would be approximately 2,000 board feet (BF) per acre, reflecting a partial cut method.¹²⁰
- To convert timber harvest in thousand board feet scribner (MBF scribner) to lumber production in MBF, the analysis uses a conversion factor of 1.3.¹²¹
- To calculate the value of potential reduction in lumber production, the analysis applies the average estimated wholesale price for ponderosa pine of \$376.48/MBF.¹²²

121. Based on these assumptions, the potential direct effect of a reduction in timber harvest on 473 acres due to Gila chub-related restrictions is estimated to be \$15,400 annually, as illustrated in Exhibit 6-5. The annual potential reduction in timber harvest of approximately 32 MBF represents less than one percent of the annual average volume harvest cut of 4,352 MBF from San Carlos Apache forests.¹²³

Exhibit 6-5						
CALCULATION OF DIRECT EFFECT OF REDUCTION IN TIMBER HARVEST FROM THE SAN CARLOS APACHE RESERVATION						
Total Potentially Impacted Timber Harvest (Acres)	Annual Potential Reduction in Timber Harvest (MBF scribner)	Annual Potential Reduction in Lumber Production (MBF)	Annual Value of Reduced Lumber Production (2004\$)	Total Value of Reduced Lumber Production (Undiscounted Dollars)	Present Value of Reduced Lumber Production (3% Discount)	Present Value of Reduced Lumber Production (7% Discount)
473	32	41	\$15,400	\$308,000	\$229,100	\$163,100

¹¹⁹ Personal communication with Dee Randall, San Carlos Apache Natural Resources Department, June 22, 2005.

¹²⁰ Final Economic Analysis of Critical Habitat Designation for the Mexican Spotted Owl, August 18, 2004, Section 3.2.2.

¹²¹ *Ibid.*, Section 3.2.2. The accepted measure for timber harvest is thousand board feet (MBF) scribner, which is not an accurate measure for lumber production. The scribner scale is based on the small end diameter of the log, while additional lumber volume can be recovered from the cone end. Thus, a conversion factor is needed to translate the harvested volume into lumber production volume.

¹²² Average estimated wholesale price for ponderosa pine of \$366.71/MBF from Inland Lumber Price Index, Western Wood Products Association, December 2003. 2003 dollars were inflated to \$376.48/MBF (2004\$) using Inflation Calculator at <http://www.bls.gov/cpi/home.htm>.

¹²³ Small Log Development Project, Draft Project Report, Beck Group, July 2003, page 5.

122. In addition to direct impacts, the Tribe is concerned with potential indirect impacts associated with a reduction in timber harvests. Specifically, the Cutter sawmill outside of Globe, Arizona, relies in part on timber from the San Carlos Apache. The Tribe operated the sawmill until 2000 when it was leased to a private company, Precision Pine of Heber, Arizona. The mill is a traditional operation employing 23 people that produces recovery grade products from large diameter trees. The Tribe decided to lease its mill operations for a variety of reasons including:

- The belief that government is not suited to run private enterprise. A private entity has more industry experience and is more suited to deal with liability issues. Also, Precision Pine has another mill in Eagar, Arizona, and may be able to capitalize on some synergies to operate the mill more efficiently.
- The Tribe is no longer responsible for supplying operating capital; this is now the private contractor's responsibility. The mill's equipment dating from the 1960's is reaching obsolescence and needs upgrades. For example, the mill closed in 2003 from April until June for maintenance needs.
- A private partnership makes it easier to get loans and grants.

123. The San Carlos Apache Tribe have proposed upgrading the mill to use the available harvest of small diameter trees. A consultant has studied the proposal and determined that this would be a profitable enterprise for the Tribe. This proposal would require a substantial investment by the Tribe. Currently the mill utilizes 4.4 million board feet (MMBF) of salvaged logs annually.¹²⁴ The annual allowable cut on San Carlos Apache lands is 5.3 MMBF.¹²⁵ In the future, depending on the option chosen, the mill could utilize up to 13.6 MMBF annually, including timber from nearby Tonto National Forest and the San Carlos Apache reservation. A redesigned mill could provide more of a market for smaller diameter logs cut during thinning treatments, improving fuels management. Without the redesigned mill, transportation costs would likely make selling smaller diameter timber uneconomical. Although the affected area and volume of lost timber harvest are relatively small, the Tribe is concerned that potential reductions could affect future operation of the sawmill and jeopardize jobs held by Tribe members, including 21 of the 25 positions at the mill and 15 loggers and drivers on the Reservation.

Recreational Activities

124. Recreation in proposed critical habitat for the Gila chub consists predominantly of dispersed fishing as well as quail and mountain lion hunting. The San Carlos Apache derive income from these activities through the issuance of general fishing licenses (covering all waterways except the Black River), big game hunting licenses, small game hunting licenses, and general recreation permits. Precise usage statistics by activity or by location are not known. Similarly, data on sales and revenues for each type of license or

¹²⁴ *Ibid.*, page 5.

¹²⁵ San Carlos Apache Tribe Forest Management Plan. Draft. Planning Period January 1, 2003 – December 31, 2015. October 2003.

permit are unavailable, primarily due to the multiple locations licenses may be purchased both on and off the reservation. Nevertheless, these fees support a number of jobs on the Reservation, including the operation of the Tribal Recreation and Wildlife Department.¹²⁶ If any restrictions related to Gila chub conservation were to affect these recreational activities, revenues and jobs could be at risk.

Fire Management Activities

125. 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.¹²⁷ If the Tribe were not able to perform fire management activities as planned, the risk of catastrophic fire on Tribal lands could increase.

6.3 Summary of Potential Impacts on Tribal Activities

126. As the socioeconomic statistics provided in this section demonstrate, the San Carlos Apache Tribe is in a substantially more vulnerable economic position than its surrounding communities or states. Unemployment on this Tribe's lands is significantly higher than in surrounding areas; any lost jobs on the Reservation would likely not be replaced by employment opportunities in other economic sectors.
127. Exhibit 6-6 summarizes the past and potential future impacts to the San Carlos Apache related to Gila chub conservation activities. Past impacts are limited to administrative and surveying costs associated with development of the 2003 Draft Fisheries Management Plan. Future impacts resulting from Gila chub conservation activities on Tribal lands could include administrative costs of consultations, surveys and monitoring, development of a final Fisheries Management Plan, modifications to grazing, timber harvesting, fire management, and recreation activities, and potential project modifications to restoration activities. Impacts in each of these areas could affect the Tribe's revenues and employment in the future. Where possible, specific impacts of Gila chub conservation efforts are quantified.

¹²⁶ 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; personal communication with David Miles, San Carlos Apache Wildlife and Recreation Department, June 15, 2005.

¹²⁷ Personal communication with Dee Randall, San Carlos Apache Natural Resources Department, June 16, 2005.

Exhibit 6-6

SUMMARY OF PAST AND FUTURE COSTS RELATED TO GILA CHUB CONSERVATION ACTIVITIES (2005 to 2024)

Description of Impact (year incurred, if known)	Stream Reaches	Total Costs (Undiscounted Dollars)	Total Costs (Present Value 3%)	Total Costs (Present Value 7%)	Annualized Costs (3%)	Annualized Costs (7%)
<i>Past Impacts</i>						
a) Surveying for species (2003)	Blue River	Unknown	Unknown	Unknown	Unknown	Unknown
b) Development of Draft Fisheries Management Plan (2003)	Bonita Creek	Unknown	Unknown	Unknown	Unknown	Unknown
	Sub-Total	Unknown	Unknown	Unknown	Unknown	Unknown
<i>Future Impacts</i>						
a) Development and Implementation of Final Fisheries Management Plan	Blue River	Unknown	Unknown	Unknown	Unknown	Unknown
b) Modifications to Forest Management Plan and Fire Management Plan [Costs related to species management - surveying and monitoring – are presented in Section 8.]	Bonita Creek	Unknown	Unknown	Unknown	Unknown	Unknown
	Sub-Total	Unknown	Unknown	Unknown	Unknown	Unknown
a) Exclusion of 473 acres of forests from timber operations	Blue River	\$308,000	\$229,100	\$163,100	\$15,400	\$15,400
	Bonita Creek	\$0	\$0	\$0	\$0	\$0
	Sub-Total	\$308,000	\$229,100	\$163,100	\$15,400	\$15,400
a) Modifications to fire management activities	Blue River	Potential increased risk of catastrophic fire.				
	Bonita Creek					
	Sub-Total					
a) Fencing-Related Costs Associated with Livestock Grazing	Blue River	\$219,000 - \$3,430,000	\$184,200 - \$2,753,800	\$155,000 - \$2,188,400	\$12,400 - \$185,100	\$14,600 - \$206,600
	Bonita Creek	\$106,000 - \$1,648,000	\$89,100 - \$1,323,200	\$75,000 - \$1,051,700	\$6,000 - \$88,900	\$7,100 - \$99,300
	Sub-Total	\$325,000 - \$5,078,000	\$273,300 - \$4,076,000	\$230,000 - \$3,240,100	\$18,400 - \$274,000	\$21,700 - \$305,800
All Impacts	Blue River	\$527,000 - \$3,738,000	\$413,300 - \$2,982,900	\$318,100 - \$2,351,500	\$27,800 - \$200,500	\$30,000 - \$222,000
	Bonita Creek	\$106,000 - \$1,648,000	\$89,100 - \$1,323,200	\$75,000 - \$1,051,700	\$6,000 - \$88,900	\$7,100 - \$99,300
	Total	\$633,000 - \$5,386,000	\$502,400 - \$4,306,100	\$393,100 - \$3,403,200	\$33,800 - \$289,400	\$37,100 - \$321,200

128. Residential and commercial development can cause riparian and cienega habitat loss and degradation that may affect the Gila chub.¹²⁸ This section focuses on development activities on private lands in the boundaries of CHD to determine whether they have been or will be affected by conservation efforts for the Gila chub and its habitat. Specifically, the analysis focuses on the past and future economic effects resulting from Gila chub conservation activities and “co-extensive” land use regulations affecting residential and commercial real estate development within proposed Gila chub CHD. Related impacts are addressed in other chapters. For example, real estate development increases demand for domestic, commercial, and industrial water use, transportation infrastructure, and recreational opportunities; each of these activities is addressed elsewhere in this report. This section presents a summary of economic impacts on real estate development, relevant background information, an overview of the methodology used to evaluate development activities and associated economic impacts, and the results of the analysis.

7.1 Summary of Economic Impacts

129. This analysis examines past and future economic impacts on residential and commercial real estate development resulting from Gila chub conservation efforts. The section below summarizes the past economic impacts and the estimated future economic impacts.

7.1.1 Summary of Past Economic Impacts

130. There have been no conference opinions or section 7 consultations addressing development projects impacting the Gila chub in the areas proposed for CHD. No significant development activities have taken place in the areas proposed for CHD to date, however, development is not prohibited in these areas. This analysis found no evidence of past economic impacts on development resulting from Gila chub conservation activities in the proposed CHD.

¹²⁸ U.S. Fish and Wildlife Service. Proposed Rule to List the Gila Chub as Endangered With Critical Habitat. (67 FR 51948) August 9, 2002.

7.1.2 Summary of Future Economic Impacts

131. Future economic impacts to development are not anticipated. Based on the location of the areas proposed for critical habitat, past and anticipated future population growth, and the current County development plans, this analysis concludes that development is unlikely to occur in areas proposed for CHD. Further research is needed to understand potential impacts on this 10-mile reach.

7.2 Background on Residential and Commercial Development

132. The Service has proposed approximately 212 miles of stream in Arizona and New Mexico for designation, which includes the area of bankfull width of designated river segments plus 300 feet on either side of the banks.¹²⁹ The Army Corps of Engineers (ACOE) issues permits for private activities that involve modifying navigable waterways and/or wetlands for construction and maintenance of structures.¹³⁰ In addition, EPA's National Pollutant Discharge Elimination System (NPDES) permit program regulates point source pollution into the waters of the United States.¹³¹ 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)."¹³² Finally, FEMA guidelines apply to lands that fall within the 100-year floodplain. The 100-year floodplain is defined as all land subject to inundation by the 100-year flood (i.e., the flood elevation with a one percent chance of being equaled or exceeded each year).
133. Because of its riparian nature, proposed CHD for Gila chub falls within the FEMA 100-year floodplain. This analysis evaluates the likelihood of any development activity that may occur in the floodplain area. It is assumed that the Federal guidelines as well as localized restrictions that govern the floodplain apply to all areas proposed for designation. FEMA guidelines as well as the county restrictions are reviewed in this section.
134. Federal guidelines govern real estate development in floodplains because many jurisdictions in flood-prone areas choose to participate in the National Flood Insurance Program (NFIP), managed by the Mitigation Division of the Federal Emergency Management Agency (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 Flood Hazard Areas and places special

¹²⁹ The bankfull width of the stream is defined by the Service as the width of the stream or river at bankfull discharge, i.e. the flow at which water begins to leave the channel and move into the floodplain.

¹³⁰ 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 United States; and (4) regional or general permits, which authorize a category of activities in a specific region.

¹³¹ Accessed at http://cfpub2.epa.gov/npdes/statestats.cfm?program_id=45&view=specific on August 30, 2002.

¹³² Accessed at http://cfpub.epa.gov/npdes/stormwater/swphase2.cfm?program_id=6 on August 30, 2002.

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.

135. 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. It 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. 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. This FEMA development regulation may require flood control facilities or other special engineering, often making development in floodways impractical and prohibitively expensive.¹³³
136. While FEMA regulates development in these areas, individual jurisdictions may place additional restrictions on construction above and beyond FEMA regulations. Exhibit 4-1 presented the floodplain restrictions currently in place for each county in which the proposed Gila chub CHD occurs on private property. Development within the floodplain is allowed in each of these counties with the restrictions noted in Exhibit 7-1.

¹³³ Personal communication with Mekbib Degaga, Riverside County Flood Control and Water Conservation District, August 18, 2004. Personal communication with Clark Pharr, Kern County Engineering and Survey Services Department, August 18, 2004.

**Exhibit 7-1
DEVELOPMENT RELATED FLOODPLAIN RESTRICTIONS BY COUNTY WITHIN THE PROPOSED CHC FOR GILA CHUB**

County	Management Organization	Ordinance	Specific Requirements
Cochise	Highway and Floodplain Department's Floodplain Management Division	Floodplain Regulations	The minimum distance of a structure from a watercourse shall be at least 50 feet and may be as great as 300 feet as determined by the Arizona Department of Water Resources (ADWR) Standard 5-96, Watercourse System Sediment Balance, and as amended. Walls and fences may also be required to meet the setback requirements.
Coconino	Coconino County Community Development Flood Control District	Zoning Ordinance	A setback is required for all new development from the lake, bay, riverfront or other body of water to create a safety buffer consisting of a natural vegetative or contour strip. This buffer shall be designated according to the flood-related erosion hazard and erosion rate, in relation to the anticipated "useful life" of structures, and depending upon the geologic, hydrologic, topographic, and climatic characteristics of the land.
Gila	Floodplain Management, Engineering, Public Works Department	Gila County Floodplain Management Ordinance	Prohibit encroachments, including fill, new construction, substantial improvements, and other development within the adopted regulatory floodway unless it has been demonstrated through hydrologic and hydraulic analyses performed in accordance with standard engineering practice that the proposed encroachment would not result in any increase in flood levels within the community during the occurrence of the base flood discharge. If no floodway is identified, then a setback of twenty (20) feet from the bank(s) of the watercourse will be established where encroachment will be prohibited.
Graham	Graham County Flood Control District	Ordinance #55 Chapter 16 - Flood Damage Prevention	Prohibit encroachments, including fill, new construction, substantial improvements and other development unless certification by a registered professional engineer or architect is provided demonstrating that encroachments shall not result in any increase in flood levels during the occurrence of the base flood discharge.
Grant (New Mexico)	New Mexico Floodplain Managers Association	NM Floodplain Statutes	For the purpose of minimizing or eliminating damage from floods prescribe standards for constructing, altering, installing or repairing buildings and other improvements under a permit system within a designated flood or mudslide hazard area.
Pima	Floodplain Management, Pima County Flood Control District	Pima County Floodplain and Erosion Hazard Management Ordinance (Title 16)	For major watercourses, with base flood peak discharges of two thousand cfs or greater, the following building setbacks shall be required where approved bank protection is not provided: 1. The building setback shall be two hundred fifty feet along major watercourses with base flood peak discharges greater than ten thousand cubic feet per second (cfs); 2. The building setback shall be one hundred feet along all other major watercourses with base flood peak discharges of ten thousand cfs or less, but more than two thousand cfs.

**Exhibit 7-1
DEVELOPMENT RELATED FLOODPLAIN RESTRICTIONS BY COUNTY WITHIN THE PROPOSED CHC FOR GILA CHUB**

County	Management Organization	Ordinance	Specific Requirements
Pinal	Pinal County Planning & Development Planning & Zoning Commission	Pinal County Zoning Ordinance	Field Inspections are conducted by the Floodplain Administrator for any washes on the property to determine how far away a structure needs to be from the wash.
Santa Cruz	Santa Cruz County Flood Control District and Floodplain Administration	Santa Cruz County Floodplain and Erosion Hazard Management Ordinance	All buildings are required to be set back a minimum distance from the top of bank of any watercourse, where approved bank protection is not provided, as follows: 1. The building setback along any straight channel reaches, or reaches with minor curvature, is to equal the square root of the peak flow of the base flood (setback = (Q100) ^{0.5}). 2. The building setback along any channel reach with obvious curvature or channel bend, or areas where the embankment is highly susceptible to erosion, is to equal the two and a half times the square root of the peak flow of the base flood (setback = 2.5(Q100) ^{0.5}). 3. The building setback for the Santa Cruz River shall be five hundred feet. 4. Along watercourses where unusual conditions do exist, building setbacks shall be established on a case-by-case basis.
Yavapai	Yavapai County Flood Control District	Drainage Criteria Manual Yavapai County Flood Control District Flood Damage Prevention Ordinance	A minimum building setback of 20 feet applies to all channel banks and floodways.

Sources:

- a <http://www.co.cochise.az.us/highways/> http://www.co.cochise.az.us/highways/floodplain_regulations.htm
- b <http://co.coconino.az.us/commdevelopment/> <http://co.coconino.az.us/commdevelopment/zoning.asp>
- c <http://www.gilacountyaz.gov/> (click on Departments --> Engineering --> Floodplain)
- <http://www.gilacountyaz.gov/default.aspx?url=HandlerPages/File.aspx&Item=2947>
- d http://www.thatcheraz.com/codes/chap16.htm#_ftn1
- e <http://www.nmfma.org/> <http://www.nmfma.org/3-18-7%20NMSA%200403.PDF>
- f <http://rfcd.pima.gov/fpm/> <http://www.pima.gov/cob/code/c.htm#Title16>
- g <http://www.co.pinal.az.us/PlanDev/> <http://www.co.pinal.az.us/PlanDev/Files/ZoningOrd.pdf>
- h <http://www.co.santa-cruz.az.us/flood/Ordinance.pdf>
- I http://www.co.yavapai.az.us/departments/dev/div/fcd/DShome_FLOOD.asp

7.3 Analytical Approach

137. Potential modifications to land use projects stemming from Gila chub conservation activities can affect landowners, consumers, and real estate markets in general. The total economic impact depends on the scope of Gila chub conservation activities, pre-existing land use and regulatory controls in the region, and the nature of regional land and real estate markets. A past consultation for the Homestead at Camp Verde master planned community in Arizona regarding impacts to threatened and endangered fish species (i.e., the Federally endangered razorback sucker, threatened spikedace and loach minnow) and their critical habitat suggests that developers may be required to undertake habitat monitoring activities, implement measures to prevent habitat and stream bank degradation, improve fencing or barrier to restrict access to habitat, reduce the risk of exotic aquatic species introduction by implementing educational programs and to prohibit backyard ponds and various recreational activities in and near streams.¹³⁴
138. To determine whether Gila chub conservation measures affected development activities in the past, this analysis reviewed conference opinions and section 7 consultations for the proposed CHD. No consultations related to development were identified. In addition, County planning officials were consulted in order to determine the use of privately owned lands which overlap with the proposed CHD. According to these communications, no significant development activities have taken place in privately held CHD.
139. Although the proposed CHD has not been developed, FEMA regulations and local ordinances do not preclude development on private lands within the proposed CHD. These regulations attempt to minimize obstructions within the floodplain that might otherwise result from unregulated development. Thus, there is potential for development activities to occur in the future. This analysis provides information on the areas within the proposed CHD most likely to be impacted by future residential and commercial development.
140. To identify areas most likely to experience residential and commercial development impacts, this analysis considers whether lands adjacent to the designation are privately or publicly owned, recent population growth rates (at Census tract and county level), and distance to the nearest city. Each of these metrics are described below.
- **Recent growth rates.** Measured as the change in population from 1990 to 2000 of the census tract within which the potential critical habitat area falls. Areas that experienced high rates of growth during this time period are assumed to be likely to experience continued population growth in the future which would spur residential or commercial development. If this development encroaches on critical habitat, developers may incur costs related to conservation activities. Conversely, it is assumed that areas which are expected to experienced low rates of population growth would not be host to residential or commercial development activities in the future.

¹³⁴ U.S. Fish and Wildlife Service, Biological Opinion Harvard Homestead (2-21-01-F-148), December 26, 2001.

Exhibit 7-2 shows the changes in population from 1990 to 2000, which ranged from zero percent to 61 percent for the areas within potential critical habitat.

- **Projected growth rates.** Measured as the projected growth in population between 2005 to 2035 at the county level. Exhibit 7-3 presents the expected county population growth from 2005 to 2025. County growth in the areas of proposed CHD are expected to be between 14 percent and 48 percent over the next 20 years.
- **Distance the nearest city.** Measured as the distance in miles to the nearest cities with populations of greater than 5,000 within a 30 mile radius of the CHD. Stream reaches closer to cities are more likely to experience residential and commercial development pressure than areas further from cities. Exhibit 7-4 presents the 12 stream reaches within a 30 mile radius of a city and the cities that lie within this area with a population of greater than 5,000 persons.¹³⁵ With only a few exceptions, the CHD stream reaches are in remote areas, more than ten miles from population centers with more than 5,000 inhabitants. Although many of the Counties containing critical habitat are expected to grow rapidly in the future, the proposed critical habitat is located on the rural fringes of these Counties.

These metrics provide information on the proposed critical habitat areas and an indication of which areas may experience development activities in the future and therefore experience impacts associated with Gila chub conservation activities.

Exhibit 7-2					
POPULATION BY STREAM REACH AT THE CENSUS TRACT LEVEL					
Area	Stream Reach	County	Tract Population 1990	Tract Population 2000	Population Change 1990- 2000
Area 1 Upper Gila River	Dix Creek	Greenlee	1,365	1,510	11%
	Eagle Creek	Graham	3,670	5,037	37%
		Greenlee	1,365	1,510	11%
	East Eagle Creek	Greenlee	1,365	1,510	11%
	Harden Cienega Creek	Greenlee	1,365	1,510	11%
		Grant	1,840	2,082	13%
	Turkey Creek (NM)	Grant	939	1,094	17%
Subtotal Area 1			11,909	14,253	20%
Area 2 Middle Gila River	Blue River	Gila	3,569	4,246	19%
		Graham	3,670	5,037	37%
	Bonita Creek	Graham	7,359	9,601	30%
	Mineral Creek	Gila	3,476	3,919	13%
		Pinal	4,445	6,315	42%
Subtotal Area 2			22,519	29,118	29%
Area 3 Babocomari	O'Donnel Canyon	Santa Cruz	2,263	2,937	30%
	Post Canyon	Santa Cruz	2,263	2,937	30%

¹³⁵ This analysis highlights the stream reaches most likely to be affected by residential and related development in the future. The cities and towns with populations greater than 5,000 within 30 miles of proposed CHD are considered to be most likely to affect proposed CHD.

**Exhibit 7-2
POPULATION BY STREAM REACH AT THE CENSUS TRACT LEVEL**

Area	Stream Reach	County	Tract Population 1990	Tract Population 2000	Population Change 1990- 2000
River	Turkey Creek	Santa Cruz	2,263	2,937	30%
	Subtotal Area 3		6,789	8,811	30%
Area 4 Lower San Pedro River	Bass Canyon	Cochise	7,974	8,918	12%
	Hot Springs Canyon	Cochise	7,974	8,918	12%
	Redfield Canyon	Graham	1,934	2,268	17%
	Subtotal Area 4		17,882	20,104	12%
Area 5 Lower Santa Cruz River	Cienega Creek	Pima	16,224	23,493	45%
	Empire Gulch	Pima	11,446	15,777	38%
	Mattie Canyon	Pima	11,446	15,777	38%
	Sabino Canyon	Pima	17,667	23,054	30%
	Subtotal Area 5		56,783	78,101	38%
Area 6 Upper Verde River	Red Tank Draw	Yavapai	8,127	8,477	4%
	Spring Creek	Yavapai	12,414	15,600	26%
	Walker Creek	Yavapai	8,127	8,477	4%
	Williamson Valley Wash	Yavapai	3,368	3,353	0%
	Subtotal Area 6		32,036	35,907	12%
Area 7 Agua Fria River	Indian Creek	Yavapai	3,268	3,502	7%
	Larry Creek	Yavapai	3,268	3,502	7%
	Little Sycamore Creek	Yavapai	3,268	3,502	7%
	Lousy Canyon	Yavapai	3,268	3,502	7%
	Silver Creek	Yavapai	3,268	3,502	7%
	Sycamore Creek	Yavapai	3,268	3,502	7%
	Subtotal Area 7		19,608	21,012	7%

Source: GIS analysis performed by IEC using U.S. Census data.

Note: 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. Shaded reaches are those without private land.

Exhibit 7-4

**CITIES WITH POPULATIONS OF 5,000 OR GREATER WITHIN 30 MILES OF
PROPOSED CRITICAL HABITAT BY STREAM REACH**

Area	Stream Reaches	City Name	City Population	Distance to City (Miles)
Area 1 Upper Gila River	Turkey Creek	Silver City	10,683	26
Area 2 Middle Gila River	Mineral Creek	Florence	7,510	27
		Globe	6,062	12
	Bonita Creek	Safford	7,359	14
Area 3 Babocomari River	O'Donnell Canyon	Nogales	19,489	27
	Turkey Creek	Sierra Vista	32,983	12
Area 5 Lower Santa Cruz	Cienega Creek	Green Valley	13,231	23
	Sabino Canyon	South Tucson	5,093	12
		Tucson	405,390	10
Area 6 Upper Verde River	Red Tank Draw	Camp Verde	6,243	8
	Spring Creek	Cottonwood	5,918	5
	Williamson Valley Wash	Prescott	26,455	22
	Spring Creek	Sedona	7,720	11
Area 7 Agua Fria River	Sycamore	Payson	8,377	29

Source: GIS analysis performed by IEc using U.S. Census data.

7.4 Past Economic Impacts

141. There have been no conference opinions or section 7 consultations regarding residential and related development for the Gila chub in the past. Further, based upon conversations with County planning officials in the areas with the largest populations and/or the highest population growth rates, including Pinal County, Pima County, Santa Cruz County, and Yavapai County, the areas proposed for critical habitat have not been developed. This analysis concludes therefore that there are no past economic impacts to development activities from Gila chub conservation activities.

7.5 Future Economic Impacts

142. Although regional and even county populations are growing rapidly, the areas proposed for critical habitat are rural, publicly owned, and due to fact that they are in riparian areas, less attractive for development. This analysis does not anticipate any impacts to development from Gila chub conservation efforts. This section presents the data used to evaluate the proposed CHD for potential development impacts and to support this conclusion.

143. This analysis assumes that any future impacts to development would be limited to areas that contain private property. Exhibit 7-5 presents the proposed areas and stream reaches that contain private property. Roughly 22 percent of the total area proposed for designation is private land. The percent of private land that makes up each area varies

from four percent of the land designated in Area 2 Middle Gila River to as much as 60 percent in Area 3 Babocomari River. Several stream reaches within the seven areas of CHD have significantly higher proportions of private land than these overall percentages. The Williamson Valley Wash stream reach in Area 6 Upper Verde River is all private land and the Cienega Creek subunit in Area 5 Lower Santa Cruz River are 95 percent privately held.

144. The remaining portion of the proposed critical habitat are public lands, owned and managed by BLM (20 percent), the Forest Service (39 percent), the State of Arizona (five percent), or Federally recognized tribes (14 percent). Although none of the Counties within the CHD indicated that the state lands would be converted to private lands, it is possible that ownership of portions of these stream reaches could change. State lands represent only five percent of the total proposed CHD.
145. Of the stream reaches with private land, those areas in close proximity to existing developed areas or to counties experiencing high rates of population growth are the most likely to experience development pressure in the future. Exhibit 7-2 presents the population for 1990 and 2000 as well as the growth rate for this time period for the census tract in which each CHD stream reach is located. Population growth between 1990 and 2000 in individual stream reaches ranged from zero percent in Williamson Valley Wash to 61 percent in Cienega Creek - County. It is important to note, however, that the total population in the majority of these census tracts was small in 2000. Only seven stream reaches are positioned within census tracts that had populations greater than 10,000 in 2000. Moreover, Empire Gulch, Mattie Canyon, and Cienega Creek - BLM, the three stream reaches with the largest census tract populations, do not contain any private land. In addition, population densities for the counties containing proposed CHD are low. In 2000 county population densities ranged from 4.6 persons per square mile in Greenlee County, Arizona to 91.9 persons per square mile in Pima County, Arizona (Section 2 discusses population density in greater detail).

Exhibit 7-5

**AMOUNT OF PRIVATE PROPERTY BY STREAM REACH
WITHIN THE PROPOSED GILA CHUB CHD**

Area	Stream reach	Private Property (Acres)^a	Percent of Total Unit Area^a
Area 1 Upper Gila River	Dix Creek	none	0%
	Eagle Creek	400	53%
	East Eagle Creek	none	0%
	Harden Cienega Creek	168	16%
	Turkey Creek	39	6%
	Total	607	16%
Area 2 Middle Gila River	Blue River	none	0%
	Bonita Creek	none	0%
	Mineral Creek	136	21%
	Total	136	4%
Area 3 Babocomari River	O'Donnell Canyon	291	64%
	Post Canyon	108	61%
	Turkey Creek	176	61%
	Total	575	60%
Area 4 Lower San Pedro River	Bass Canyon	167	66%
	Hot Springs Canyon	40	9%
	Redfield Canyon	227	43%
	Total	434	35%
Area 5 Lower Santa Cruz River	Cienega Creek	738	95%
	Empire Gulch	none	0%
	Mattie Canyon	none	0%
	Sabino Canyon	3	1%
	Total	741	32%
Area 6 Upper Verde River	Red Tank Draw	64	13%
	Spring Creek	141	54%
	Walker Creek	74	21%
	Williamson Valley Wash	328	100%
	Total	607	42%
Area 7 Agua Fria River	Indian Creek	23	6%
	Larry Creek	none	0%
	Little Sycamore Creek	128	59%
	Lousy Canyon	none	0%
	Silver Creek	none	0%
	Sycamore Creek	179	21%
Total	330	17%	
Total		3,266	22%

Source: GIS analysis performed by IEc using proposed Gila chub critical habitat layer provided by the Service in May 2005. Arizona Landuse Summary.

^a Note, these estimates are provided for context only. The CHD rule provides the legal descriptions of the units. Shaded stream reaches are those without private land.

146. In addition, using historical population growth as a proxy indicator for future development, this analysis examined projected growth in county population. Exhibit 7-6 presents the current and projected population for the nine counties containing proposed

critical habitat. Over the next 10 years, population in Arizona and New Mexico as a whole are expected to increase by 21 and 14 percent respectively. Yavapai, Santa Cruz, Pinal, Pima, and Graham Counties are expected to witness the largest population increases, with population growth of 25, 19, 19, 19, and 20 percent respectively over the next ten years. Although not directly comparable to the census tract population presented in Exhibit 7-2, these growth rates appear to be in line with historical growth and thus, significant changes in population trends in areas proposed for CHD are not anticipated.

Exhibit 7-6						
POPULATION PROJECTION OF COUNTIES CONTAINING CRITICAL HABITAT FOR THE GILA CHUB						
State	As of July 1	2005	2015	% change from 2005	2025	% change from 2005
Arizona	State Total	5,553,825	6,744,800	21.4	7,993,000	43.9
	Cochise	129,675	143,800	10.9	155,425	19.9
	Gila	51,650	57,625	11.6	63,750	23.4
	Graham	39,425	47,175	19.7	54,050	37.1
	Greenlee	9,300	9,925	6.7	10,600	14.1
	Pima	943,800	1,119,350	18.6	1,291,000	36.8
	Pinal	181,475	216,225	19.1	244,425	34.7
	Santa Cruz	42,150	50,550	19.1	59,800	41.9
	Yavapai	175,700	219,625	25.0	260,775	48.4
New Mexico	State Total	1,956,725	2,232,424	14.1	2,534,964	29.6
	Grant	33,276	36,674	10.2	39,807	19.6

Source:
Arizona: Arizona Department of Economic Security, Research Administration, Population Statistics Unit. <http://www.library.Arizona.edu/library/teams/sst/geo/guide/azpop-projs.html>.
New Mexico: Bureau of Business and Economic Research, University of New Mexico. Released 1997. <http://www.unm.edu/~bber/demo/popproj.htm>

147. While the population growth may lead to development in several Counties containing critical habitat, it is unlikely that development would occur in the vicinity of the proposed critical habitat. Only twelve of the 30 stream reaches are within thirty miles of a city with more than 5,000 inhabitants and only three stream reaches are within 10 miles. Sabino Canyon, which is roughly 10 miles from Tuscon, has only three acres, or one percent, private land. Red Tank Draw and Spring Creek, which are eight and five miles respectively from a city with a population of more than 5,000 are in Yavapai County. According to Yavapai County Development Services Office, development in the CHD areas that fall within the County is unlikely, with the exception of Williamson Valley Wash.¹³⁶ Because the Williamson Valley Wash area has been sub-divided, development activities do not have to be explicitly approved by the County. As a result, the Development Services Office could not state with certainty that development would not occur in Williamson Valley Wash.¹³⁷ However, the location of the critical habitat

¹³⁶ Personal communication with Chris Bridges, Yavapai County Development Services on June 8, 2005.

¹³⁷ Personal communication with Chris Bridges, Yavapai County Development Services on June 8, 2005.

within Williamson Valley Wash is 22 miles from the nearest city. The remote nature of this stream reaches makes future development unlikely.

148. Integrating the population, ownership, and geographic characteristics of the CHD stream reaches, as presented in Exhibit 7-7, provides a clearer picture of the potential for development in the critical habitat than any one indicator and suggests that development in Gila chub critical habitat is unlikely in the future. In Pima County, for example, population is expected to grow by 19 percent, but the CHD stream reaches with the largest census tract populations in 2000 do not contain private land. Although population growth in Yavapai County is expected to be 25 percent, the population of the Williamson Valley Wash census tract was only slightly over 3,000 in 2000 and did not change between 1999 and 2000.
149. This analysis sought confirmation from county planning offices regarding past and future development activities in CHD units that contain private land, are located in counties expected to witness population growth in the next ten years, and are within 30 miles of a city with a population greater than 5,000.
- Two stream reaches in Santa Cruz county, O'Donnell Canyon and Turkey Creek, met these criteria. The County planning office confirmed that there is no development slated for these critical habitat areas.¹³⁸ However, it is zoned for General Rural development. The purpose of this designation is "to accommodate a residence on one hundred eighty thousand (180,000) square feet. A lifestyle of a rural nature with accommodations for animals and agriculture is the intent of this district."¹³⁹ While development in these areas is not prohibited, the rural nature of the areas indicates that it is unlikely that the proposed critical habitat would be disturbed.
 - The data analysis yielded a similar scenario for stream reaches in Pinal County. Pinal County Planning and Development Services, however, confirmed that there are currently no development plans for the stream reaches within its borders.¹⁴⁰ According to this office, the lands proposed for CHD in Pinal County are classified as Natural Resource Areas. The Pinal County Comprehensive Plan defines a Natural Resource Area as "private and public lands, including State Trust lands which contain one or more natural resources that are enhanced by maintaining the parcels in large, undivided holdings. Land uses may include active and passive parks, river corridors, natural areas, livestock grazing, conservation leases, national forests, hunting and public recreation, and wilderness areas."¹⁴¹
 - The Redfield and Eagle Creek stream reaches in Graham county are zoned for general land use, according to the county. However, the county emphasized that

¹³⁸ Personal communication with Rick Hindmann, Staff Planner, Santa Cruz County, Arizona on June 9, 2005.

¹³⁹ Santa Cruz County GR General Rural Sec. 901 Purpose and Intent, page 1.

¹⁴⁰ Personal communication with Jerry Stabley, Pinal County Planning and Development Services, Pinal County, Arizona on June 8, 2005.

¹⁴¹ Pinal County. Pinal County Comprehensive Plan, page 26.

these are very remote locations.¹⁴² Exhibit 7-7 confirms that these units are more than 30 miles from a city of 5,000 inhabitants. Despite the fact that there has been double digit population in the census tract containing this stream reach and that double digit growth is expected to continue, no development impacts are anticipated for these units due to the location.

- Cochise county confirmed that development impacts are unlikely in Hot Springs Canyon and Bass Canyon. Private lands in these stream reaches are owned by the state. Only one parcel has been sub-divided and zoned for sparse development, one house for every four acres. The remaining state lands have not been sub-divided and thus no development is anticipated.¹⁴³ As Exhibit 7-7 highlights, population growth in the vicinity of these CHD stream reaches has been modest in comparison to other areas within CHD and is anticipated to continue at the same pace. Further, these stream reaches are more than 30 miles from a city with more than 5,000 inhabitant. No development impacts are anticipated for these stream reaches.
- Yavapai county confirmed that there is no development anticipated for the portions of its county proposed for critical habitat designation.¹⁴⁴ These areas are primarily zoned for residential development of single family homes. Zoning regulation require that each residence be situated on a minimum of two acres.¹⁴⁵ Given the nature of the zoning regulations, which seeks to preserve the rural nature of these areas, development impacts are not anticipated. Moreover, with the exception of Red Tank Draw and Spring Creek, the stream reaches of proposed CHD in Yavapai county are more than 20 miles from the nearest city with 5,000 inhabitants.
- Pima county confirmed that there is little to no development in the Cienega Creek area.¹⁴⁶ The county confirmed that there has been development in the greater Cienega Creek area in the past. There are currently no rezoning applications in the Cienega Creek area. The proposed critical habitat is located more than 20 miles from a city of more than 5,000 inhabitants.

150. This analysis concludes that development is unlikely to occur in the areas proposed for CHD. Further, this analysis concludes that no economic impacts to development from Gila chub conservation will occur in the future.

¹⁴² Personal communication with Maryanne Antillon, Graham County Planning and Zoning, Graham County, Arizona on June 22, 2005.

¹⁴³ Personal communication with Maria Dayton, Cochise County Planning and Zoning, Cochise County, Arizona on June 22, 2005.

¹⁴⁴ New information was provided in August 2005 indicating a potential development project located near the Spring Creek stream reach is in the planning stages. Any additional information on this potential project will be discussed in the final analysis.

¹⁴⁵ 2003 Yavapai Counting Planning and Zoning Ordinance, accessed online at <http://www.co.yavapai.az.us/departments/Dev/unitspc/ordregs/zo/zoningordinance.pdf>, on June 23, 2005. Classifications for these areas are RCU2A, R1L 175, and R1L 15A.

¹⁴⁶ Written communication with Sherry Ruther, Environmental Planning Manager, Pima County Development Services, July 11, 2005.

Exhibit 7-7

POTENTIAL FOR DEVELOPMENT IN THE PROPOSED GILA CHUB CRITICAL HABITAT

Area	Stream reach	County	Private Property in Stream reach (% of total acreage)	Census Tract Population Change 1990 to 2000	Projected 10-year County-Level Population Growth (2005 to 2015)	Distance to Nearest City (Population > 5,000)	Development Allowed by Regulations	Future Development Likely
Area 1 Upper Gila River Unit	Dix Creek	Greenlee	None	11%	6.7%	>30 miles	N/A	No
	Eagle Creek	Graham	53%	37%	19.7%	>30 miles	Yes	No
		Greenlee		11%	6.7%	>30 miles		
	East Eagle Creek	Greenlee	None	11%	6.7%	>30 miles	N/A	No
	Harden Cienega Creek	Greenlee	16%	11%	6.7%	>30 miles	Yes	No
		Grant		13%	10.2%	>30 miles		
Turkey Creek (NM)	Grant	6%	17%	10.2%	26 miles	Yes	No	
Area 2 Middle Gila River Unit	Blue River	Gila	None	19%	11.6%	>30 miles	N/A	No
		Graham		37%	19.7%	>30 miles		
	Bonita Creek	Graham	None	30%	19.7%	14 miles	N/A	No
	Mineral Creek	Gila	21%	13%	11.6%	27 miles	Yes	No
		Pinal		42%	19.1%	12 miles		
Area 3 Babocomari River Unit	O'Donnell Canyon	Santa Cruz	64%	30%	19.1%	27 miles	Yes	No
	Post Canyon	Santa Cruz	61%	30%	19.1%	>30 miles	Yes	No
	Turkey Creek	Santa Cruz	61%	30%	19.1%	12 miles	Yes	No
Area 4 Lower San Pedro River Unit	Bass Canyon	Cochise	66%	12%	10.9%	>30 miles	Yes	No
	Hot Springs Canyon	Cochise	9%	12%	10.9%	>30 miles	Yes	No
	Redfield Canyon	Graham	43%	17%	19.7%	>30 miles	Yes	No

Exhibit 7-7 (continued)

POTENTIAL FOR DEVELOPMENT IN THE PROPOSED GILA CHUB CRITICAL HABITAT

Area	Stream Reach	County	Private Property in Stream Reach (% of total acreage)	Census Tract Population Change 1990 to 2000	Projected 10-year County-Level Population Growth (2005 to 2015)	Distance to Nearest City (Population > 5,000)	Development Allowed by Regulations	Future Development Likely
Area 5 Lower Santa Cruz River	Cienega Creek	Pima	53%	45%	18.6%	23 miles	Yes	No
	Empire Gulch	Pima	None	38%	18.6%	>30 miles	N/A	No
	Mattie Canyon	Pima	None	38%	18.6%	>30 miles	N/A	No
	Sabino Canyon	Pima	1%	30%	18.6%	10 miles	Yes	No
Area 6 Upper Verde River Unit	Red Tank Draw	Yavapai	13%	4%	25.0%	8 miles	Yes	No
	Spring Creek	Yavapai	54%	26%	25.0%	5 miles	Yes	No
	Walker Creek	Yavapai	21%	4%	25.0%	>30 miles	Yes	No
	Williamson Valley Wash	Yavapai	100%	0%	25.0%	22 miles	Yes	No
Area 7 Agua Fria River Unit	Indian Creek	Yavapai	6%	7%	25.0%	>30 miles	Yes	No
	Larry Creek	Yavapai	None	7%	25.0%	>30 miles	N/A	No
	Little Sycamore Creek	Yavapai	59%	7%	25.0%	>30 miles	Yes	No
	Lousy Canyon	Yavapai	None	7%	25.0%	>30 miles	N/A	No
	Silver Creek	Yavapai	None	7%	25.0%	>30 miles	N/A	No
	Sycamore Creek	Yavapai	21%	7%	25.0%	29 miles	Yes	No

Source: GIS analysis performed by IEc using U.S. Census data.

Note: Where stream reach 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.

151. This section discusses impacts of Gila chub conservation efforts on species and habitat management, recreation, fire management, mining, and transportation activities. The first section provides a summary of the impacts of all of the above mentioned activities. The second section estimates impacts of species and habitat management. The third section discusses impact on recreation activities. The fourth section describes the potential impacts to fire management. The fifth section discusses potential mining impacts. The last section estimates impacts on transportation activities.

8.1 Summary of Impacts to Other Activities

8.1.1 Summary of Past Economic Impacts to Other Activities

152. Conservation efforts for the Gila chub have impacted species and habitat management, recreation, and fire management activities. The impacts to each of these activities is described briefly in this section. For a more complete discussion of past impact of Gila chub conservation efforts, see Section 3.

8.1.2 Summary of Future Economic Impacts to Other Activities

153. This analysis estimates the total economic impact of Gila chub conservation efforts on species and habitat management, recreation, fire management, mining, and transportation activities to be \$1.3 million to \$2.9 million over the next 20 years (undiscounted dollars). Exhibit 8-1 presents the estimated costs of impacts to other activities by proposed CHD area and stream reach.

Exhibit 8-1

SUMMARY OF ESTIMATED COSTS OF GILA CHUB CONSERVATION ACTIVITIES FOR OTHER ACTIVITIES

Area	Stream Reaches	Gila chub Specific Mgt.	Recreation	Fire Mgt. (WUI Acres)	Mining	Transportation	Total Constant Dollars	Present Value (3%)	Present Value (7%)
Area 1 Upper Gila River	Turkey Creek	\$20,000	Modest	0	n/a	\$0	\$20,000	\$15,000	\$11,000
	Dix Creek	\$20,000	n/a	0	n/a	\$0	\$20,000	\$15,000	\$11,000
	Harden Cienega Creek	\$20,000	n/a	0	n/a	\$0	\$20,000	\$15,000	\$11,000
	Eagle Creek	\$50,000-\$108,000	n/a	0	n/a	\$0	\$50,000-\$108,000	\$37,000-\$80,000	\$27,000-\$57,000
	East Eagle Creek	\$20,000	n/a	0	n/a	\$0	\$20,000	\$15,000	\$11,000
	Subtotal	\$130,000-\$188,000	Modest	0	n/a	\$0	\$130,000-\$188,000	\$97,000-\$140,000	\$71,000-\$101,000
Area 2 Middle Gila River	Mineral Creek	\$50,000-\$108,000	n/a	0	Uncertain	\$0	\$50,000-\$108,000	\$37,000-\$80,000	\$27,000-\$57,000
	Blue River	\$80,000-\$138,000	n/a	0	n/a	\$0	\$80,000-\$138,000	\$60,000-\$103,000	\$42,000-\$73,000
	Bonita Creek	\$80,000-\$138,000	Unlikely	5	n/a	\$0	\$80,000-\$138,000	\$60,000-\$103,000	\$42,000-\$73,000
	Subtotal	\$210,000-\$384,000	Unlikely	5	n/a	\$0	\$210,000-\$384,000	\$157,000-\$286,000	\$111,000-\$203,000
Area 3 Babocomari River	O'Donnell Canyon	\$50,000-\$108,000	n/a	0	n/a	\$11,000-\$75,000	\$61,000-\$183,000	\$45,000-\$136,000	\$32,000-\$97,000
	Turkey Creek	\$50,000-\$108,000	n/a	0	n/a	\$11,000-\$75,000	\$61,000-\$183,000	\$45,000-\$136,000	\$32,000-\$97,000
	Post Canyon Creek	\$90,000-\$148,000	n/a	0	n/a	\$0	\$90,000-\$148,000	\$75,000-\$118,000	\$62,000-\$92,000
	Subtotal	\$190,000-\$364,000	n/a	0	n/a	\$22,000-\$150,000	\$212,000-\$514,000	\$165,000-\$390,000	\$126,000-\$286,000
Area 4 Lower San Pedro River	Bass Canyon	\$50,000-\$108,000	n/a	0	n/a	\$0	\$50,000-\$108,000	\$37,000-\$80,000	\$27,000-\$57,000
	Hot Springs Canyon	\$50,000-\$108,000	Unlikely	0	n/a	\$0	\$50,000-\$108,000	\$37,000-\$80,000	\$27,000-\$57,000
	Redfield Canyon	\$50,000-\$108,000	n/a	0	n/a	\$0	\$50,000-\$108,000	\$37,000-\$80,000	\$27,000-\$57,000
	Subtotal	\$150,000-\$324,000	Unlikely	0	n/a	\$0	\$150,000-\$324,000	\$111,000-\$240,000	\$81,000-\$171,000
Area 5 Lower Santa Cruz River	Cienega Creek	\$50,000-\$108,000	n/a	150	n/a	\$33,000-\$224,000	\$83,000-\$332,000	\$62,000-\$247,000	\$44,000-\$176,000
	Mattie Canyon	\$50,000-\$108,000	n/a	0	n/a	\$0	\$50,000-\$108,000	\$37,000-\$80,000	\$27,000-\$57,000
	Empire Gulch	\$50,000-\$108,000	n/a	0	n/a	\$0	\$50,000-\$108,000	\$37,000-\$80,000	\$27,000-\$57,000
	Sabino Canyon	\$20,000	Uncertain	1	n/a	\$0	\$20,000	\$15,000	\$11,000
	Subtotal	\$170,000-\$344,000	Uncertain	151	n/a	\$33,000-\$224,000	\$203,000-\$568,000	\$151,000-\$422,000	\$109,000-\$301,000

Exhibit 8-1 (continued)

SUMMARY OF ESTIMATED COSTS OF GILA CHUB CONSERVATION ACTIVITIES FOR OTHER ACTIVITIES

Area	Stream Reaches	Gila chub Specific Mgt.	Recreation	Fire Mgt. (WUI Acres)	Mining	Transportation	Total Undiscounted Dollars	Present Value (3%)	Present Value (7%)
Area 6 Upper Verde River	Walker Creek	\$20,000	Unlikely	0	n/a	\$10,000-\$145,000	\$30,000-\$253,000	\$22,000-\$188,000	\$16,000-\$134,000
	Red Tank Draw	\$20,000	Unlikely	0	n/a	\$10,000-\$145,000	\$30,000-\$165,000	\$22,000-\$122,000	\$16,000-\$87,000
	Spring Creek	\$50,000-\$108,000	Unlikely	206	n/a	\$11,000-\$75,000	\$61,000-\$183,000	\$45,000-\$136,000	\$32,000-\$97,000
	Williamson Valley Wash	\$50,000-\$108,000	n/a	0	n/a	\$0	\$50,000-\$108,000	\$37,000-\$80,000	\$27,000-\$57,000
	Subtotal	\$140,000-\$344,000	Unlikely	206	n/a	\$31,000-\$365,000	\$171,000-\$709,000	\$126,000-\$526,000	\$91,000-\$375,000
Area 7 Aqua Fria River	Little Sycamore Creek	\$50,000-\$108,000	Unlikely	0	n/a	\$0	\$50,000-\$108,000	\$37,000-\$80,000	\$27,000-\$57,000
	Sycamore Creek	\$20,000	Unlikely	0	n/a	\$0	\$20,000	\$15,000	\$11,000
	Indian Creek	\$20,000	Unlikely	0	n/a	\$0	\$20,000	\$15,000	\$11,000
	Silver Creek	\$80,000	Unlikely	0	n/a	\$0	\$80,000	\$60,000	\$42,000
	Larry Creek	\$10,000	Unlikely	0	n/a	\$0	\$10,000	\$7,000	\$5,000
	Lousy Canyon	\$10,000	Unlikely	0	n/a	\$0	\$10,000	\$7,000	\$5,000
	Subtotal	\$190,000-\$248,000	Unlikely	0	n/a	\$0	\$190,000-\$248,000	\$141,000-\$184,000	\$101,000-\$131,000
Total		\$1,180,000-\$2,196,000	Modest	362	Uncertain	\$86,000-\$737,000	\$1,266,000-\$2,935,000	\$948,000-\$2,188,000	\$690,000-\$1,568,000
Annualized							\$64,000-\$147,000	\$65,000-\$148,000	

Note: Totals may not sum due to rounding.

8.2 Impact on Gila Chub Specific Management

154. This section provides information on potential Gila chub specific management for the Gila chub and other native fishes. Future species and habitat management may include re-establishment of Gila chub, constructing fish barriers, and surveying and monitoring. We assume that monitoring and surveying activities take place in all critical habitat areas. The cost of these activities are estimated to be \$1,000 annually for stream reaches managed by USFS, and between \$2,500 and \$5,400 annually for stream reaches not managed by USFS.¹⁴⁷ Monitoring and surveying costs are assumed to be independent of river miles monitored unless specifically noted (i.e., Lousy and Larry Canyons). Habitat managers and/or landowners are expected to incur monitoring and surveying costs. For a number of units, habitat managers noted additional costs. These additional conservation efforts are noted by critical habitat area in the sections that follow. In total, Gila chub management efforts are estimated to be between \$1,020,000 and \$1,948,000 over the next twenty years.

Area 2: Middle Gila River

- **Blue River:** The Arizona Game and Fish Department and the Bureau of Reclamation proposed constructing a fish barrier on the Blue River stream reach.¹⁴⁸ The purpose of the fish barrier would be to keep non-native species from entering Gila chub habitat. This project is in the proposal stage. The estimated cost of constructing this fish barrier is \$30,000.¹⁴⁹
- **Bonita Creek:** The Arizona Game and Fish Department has also proposed constructing a fish barrier on the Bonita Creek stream reach.¹⁵⁰ While, as with the proposed fish barrier on Blue River, this fish barrier is merely a proposal at present, estimated costs of constructing this fish barrier are \$30,000.¹⁵¹

¹⁴⁷ The cost of monitoring USFS managed stream reaches provided by personal communication with Jerry Monzingo, Fisheries Biologist, Gila National Forest, June 9, 2005. The cost of monitoring non-USFS managed stream reaches estimated based on: Project 198402500-Protect and Enhance Anadromous Fish Habitat in Grande Ronde Basin Streams: Oregon Department of Fish and Wildlife; Draft 5-23-2003:MP-1: Sampling Procedures, Designs, and Projected Costs: Fish passage projects effectiveness monitoring (Culverts, Bridges, Fishways, Logjams, Dam removal), prepared by Washington Salmon Recovery Funding Board, June 2003; BPA-Fish and Wildlife Program FY99 Proposal: North Fork John Day Area Riparian Fencing: Umatilla National Forest; and Project 199900600-Restoration of Riparian Habitat in Bakeoven/Deep Creeks: Wasco Soil and Water Conservation District. The Arizona Game and Fish Department confirmed monitoring costs for stream reaches not managed by USFS will be higher. Written communication with Rob Bettaso, Arizona Game and Fish Department, June 21, 2005. A stream reach is assumed to be managed by USFS if at least 50 percent of the acreage is owned by USFS (see Exhibit 2-2 for a breakdown of ownership classification).

¹⁴⁸ Written communication from Robert Bettaso, Arizona Game and Fish Department, June 21, 2005.

¹⁴⁹ The cost of Arizona Game and Fish Department constructing a fish barrier is assumed to be similar to costs of fish barrier construction estimated by the Bureau of Land Management (\$30,000). Written communication Ted Cordery, Endangered Species Coordinator, Arizona State Office, Bureau of Land Management, July 20, 2005.

¹⁵⁰ Written communication from Robert Bettaso, Arizona Game and Fish Department, June 21, 2005.

¹⁵¹ The cost of Arizona Game and Fish Department constructing a fish barrier is assumed to be similar to costs of fish barrier construction estimated by the Bureau of Land Management (\$30,000). Written communication Ted Cordery, Endangered Species Coordinator, Arizona State Office, Bureau of Land Management, July 20, 2005.

Area 3: Babocomari River

- **Post Canyon:** The Arizona Game and Fish Department has started to draft a plan to reestablish Gila chub in the Post Canyon stream reach.¹⁵² At this time information the expected date of completion is not available. BLM estimates that reestablishment of Gila chub is will cost \$40,000 over five years.¹⁵³

Area 5: Lower Santa Cruz River

- **Sabino Canyon:** In 2003, Gila chub were salvaged from Sabino Canyon during the Aspen Fire by the USFS. Gila chub were returned to the stream reach in May 2005.¹⁵⁴ Annual monitoring of the Sabino Canyon stream reach population is expected.¹⁵⁵ Total Gila chub monitoring efforts are anticipated to cost \$20,000 (undiscounted dollars) over the next 20 years.¹⁵⁶

Area 7: Agua Fria River

- **Lousy and Larry Canyons:** In 1995 Larry and Lousy Creek stream reaches were stocked with Gila chub from Silver Creek by BLM. Since that time these two stream reaches have been monitored annually. Annual monitoring efforts will continue into the future.¹⁵⁷ Total Gila chub monitoring efforts for both these reaches are anticipated to cost \$50,000 to \$108,000 (undiscounted dollars) over the next 20 years.¹⁵⁸
- **Silver Creek:** BLM is considering constructing fish barriers on Silver and Dry Creeks. BLM estimates that the total cost of both of these fish barriers may be as much as \$60,000.¹⁵⁹

¹⁵² Written communication from Robert Bettaso, Arizona Game and Fish Department, June 21, 2005.

¹⁵³ The cost of Arizona Game and Fish Department constructing a fish barrier is assumed to be similar to costs of fish barrier construction estimated by Bureau of Land Management (\$40,000). Written communication Ted Cordery, Endangered Species Coordinator, Arizona State Office, Bureau of Land Management, July 20, 2005.

¹⁵⁴ Written communication from Don Mitchell, Fisheries Program Manager, Region V, Arizona Game and Fish Department, May 10, 2005. Written communication from Service Biologist, May 11, 2005.

¹⁵⁵ Surveying and monitoring efforts are assumed to be similar to those in Lousy Canyon. The Lousy Canyon stream reach population of Gila chub is surveyed annually, since re-establishment in 1995. Written communication from Robert Bettaso, Arizona Game and Fish Department, June 21, 2005.

¹⁵⁶ The annual cost of Gila chub monitoring is assumed to be similar to the cost of monitoring in the Turkey Creek stream reach (New Mexico), \$1,000. The annual cost of Gila chub monitoring in the Turkey Creek stream reach was provided by personal communication with Jerry Monzingo, Fisheries Biologist, Gila National Forest, June 9, 2005.

¹⁵⁷ Written communication from Robert Bettaso, Arizona Game and Fish Department, June 21, 2005.

¹⁵⁸ The annual cost of Gila chub monitoring is assumed to be similar to the cost of monitoring in the Turkey Creek stream reach (New Mexico), \$1,000. The annual cost of Gila chub monitoring in the Turkey Creek stream reach was provided by personal communication with Jerry Monzingo, Fisheries Biologist, Gila National Forest, June 9, 2005.

¹⁵⁹ Written communication Ted Cordery, Endangered Species Coordinator, Arizona State Office, Bureau of Land Management, July 20, 2005.

8.3 Impacts on Recreation

155. The proposed rule states that concentrated recreational activity such as wading, swimming, walking, and OHV (Off-highway vehicles) use may affect the Gila chub and proposed CHD.¹⁶⁰ The Service states that recreational activity in Gila chub CHD may result in crushed and/or trampled vegetation on banks and terraces. In addition, it may alter channel morphology. OHVs may cause sedimentation if they directly disturb and crush vegetation to the point that bare soil is exposed.
156. This section estimates the economic impacts of Gila chub conservation activities on recreation. First, this section presents background information on the importance of the recreation industry to the region. Second, the section summarizes the past economic impacts within the proposed CHD. Lastly, this section estimates the future economic impacts of Gila chub conservation activities within the proposed CHD. Throughout the section, impacts to Arizona are emphasized because all but one CHD area are in Arizona. One area, Turkey Creek, is in Grant County, New Mexico.

8.3.1 Background Information on Recreation

157. OHV use, fishing, and hunting are common recreational activities in the areas proposed for CHD.¹⁶¹ The Arizona State University West School of Management's Dr. Silberman published two reports on the importance of OHV use, hunting, and fishing to Arizona's economy. 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 38 percent of these OHV-related expenditures are spent within counties containing proposed critical habitat for the Gila chub. Exhibit 8-2 presents the number of days spent participating in and expenditures on OHV recreation within the proposed CHD in 2002.

¹⁶⁰ U.S. Fish and Wildlife Service. Proposed Rule to List the Gila Chub as Endangered With Critical Habitat. (67 FR 51948) August 9, 2002.

¹⁶¹ The policy for driving motorized vehicles on Arizona's National Forests is related to the State of Arizona's motor vehicle policy. "Driving off of forest roads is not encouraged but may be legal if no damage is done to plants or soils or if wildlife is not harassed and if a muffler/spark arrestor is in place." US Forest Service. OHV's on Arizona's National Forests. Accessed at <http://www.fs.fed.us/r3/ohv/> on July 20, 2005.

Exhibit 8-2

**NUMBER OF DAYS DRIVERS SPENT DRIVING AND EXPENDITURES
ON OFF-HIGHWAY RECREATION IN 2002**

	Total Days	Residents	Traveling	Expenditure (Millions)	Percentage of State Total
Arizona	12,224,707	5,499,797	6,724,907	\$842.3	
Cochise	435,134	180,697	254,437	\$27.7	3.3%
Gila	1,262,607	228,071	1,034,536	\$67.1	8.0%
Graham	209,712	66,020	143,692	\$12.4	1.5%
Greenlee	88,926	32,787	56,139	\$5.3	0.6%
Pima	836,803	535,254	301,549	\$71.7	8.5%
Pinal	600,020	197,918	402,102	\$40.2	4.8%
Santa Cruz	406,935	35,152	371,783	\$20.8	2.5%
Yavapai	1,195,742	416,824	778,918	\$70.6	8.4%
County Totals	5,035,879.0	1,692,723.0	3,343,156.0	\$315.8	37.5%

Source: Silverman, PhD. The Economic Importance of Off-Highway Vehicle Recreation. Arizona State University West, School of Management.

*Residents are defined as local residents within their own county.

Traveling is defined as residents traveling within the state in pursuit of OHV recreation.

158. In addition to its overview of the OHV market, Dr. Silberman published a similar report on fishing and hunting in Arizona, "The Economic Importance of Fishing and Hunting" He estimates that 6.5 million days are spent fishing and hunting in Arizona annually. Roughly 25.6 percent of the total hunting and fishing days are spent within counties containing proposed critical habitat for the Gila chub. Exhibit 8-3 presents the number of days spent participating in fishing and hunting recreation within the proposed CHD in 2001.

Exhibit 8-3

NUMBER OF HUNTING AND FISHING DAYS BY COUNTY IN ARIZONA WITH GILA CHUB PROPOSED CHD

	Fishing				% of State	Hunting				% of State	Combined	
	AZ County	AZ Traveling	Non-Resident	Total		AZ County	AZ Traveling	Non-Resident	Total		Total Hunting and Fishing	% of State
Arizona	2,262,136	2,702,157	338,414	5,302,707		523,247	540,929	124,828	1,189,004		6,491,711	
Cochise	6,409	26,362	728	33,499	0.6%	25,340	46,738	13,738	85,816	7.2%	119,315	1.8%
Gila	47,541	350,037	15,796	413,374	7.8%	17,672	52,422	5,416	75,510	6.4%	488,884	7.5%
Graham	6,515	28,755	2,282	37,552	0.7%	12,069	17,721	9,032	38,822	3.3%	76,374	1.2%
Greelee	324	245	910	1,479	0.0%	2,821	24,863	770	28,454	2.4%	29,933	0.5%
Pima	127,725	25,986	182	153,893	2.9%	89,215	24,428	17,702	131,345	11.0%	285,238	4.4%
Pinal	1,555	22,968	279	24,802	0.5%	17,141	71,458	6,282	94,881	8.0%	119,683	1.8%
Santa Cruz	6,211	101,006	1,357	108,574	2.0%	4,828	26,118	8,012	38,958	3.3%	147,532	2.3%
Yavapai	81,219	191,793	3,395	276,407	5.2%	34,760	76,466	7,131	118,357	10.0%	394,764	6.1%
County Totals	227,499	747,152	24,929	1,049,580	19.8%	203,846	340,214	68,083	612,143	51.5%	1,661,723	25.6%

Source: Silverman, PhD. The Economic Importance of Fishing and Hunting. Arizona State University West, School of Management.

159. Recreators spent more than \$550 million on hunting and fishing in 2001 in Arizona, of which an estimated 26.6 percent was spent within counties containing proposed critical habitat for the Gila chub. Exhibit 8-4 presents the total expenditures of recreators participating in fishing and hunting recreation within the proposed CHD in 2001.

Exhibit 8-4

TRIP RELATED EXPENDITURES ON HUNTING AND FISHING BY COUNTIES IN ARIZONA WITH GILA CHUB PROPOSED CHD (2001)

	Fishing		Hunting		Combined	
	Expenditures (\$mil)	% of State	Expenditures (\$mil)	% of State	Total (\$mil)	% of State
Arizona	416.0		126.5		543	
Cochise	6.7	1.6%	6.0	4.7%	13	2.3%
Gila	25.4	6.1%	5.2	4.1%	31	5.6%
Graham	2.5	0.6%	3.4	2.7%	6	1.1%
Greelee	0.4	0.1%	1.9	1.5%	2	0.4%
Pima	22.7	5.5%	17.6	13.9%	40	7.4%
Pinal	6.9	1.7%	6.8	5.4%	14	2.5%
Santa Cruz	6.4	1.5%	2.7	2.1%	9	1.7%
Yavapai	19.9	4.8%	9.7	7.7%	30	5.5%
Total CHD	90.9	21.9%	53.3	42.1%	144	26.6%

Source: Silverman, PhD. The Economic Importance of Fishing and Hunting. Arizona State University West, School of Management.

160. Proposed critical habitat for the Gila chub in New Mexico is located within the Gila Wilderness at the Turkey Creek stream reach.¹⁶² The Gila Wilderness is managed by the Forest Service as part of the Gila National Forest. Management activities consists of maintaining natural conditions and providing protection to natural features and vegetative communities. Dispersed recreation is managed at low intensity and OHV use is prohibited.

8.3.2 Summary of Past Recreation Impacts

161. In 2002, a conference opinion was completed for the Gila Chub regarding recreation in the Las Cienegas National Conservation Area which includes Cienega Creek, Empire Gulch, and Mattie Canyon in Area 5: Santa Cruz River.¹⁶³ OHVs, wading, bathing, and swimming were considered as possible threats to the Gila chub and the following conservation activities were recommended by the Service:

- Reducing the speed limit to 10 MPH at stream crossings;
- Posting the speed limit at each crossing; and
- Creating a public education program.

The conference opinion and its costs are discussed in greater detail in Section 3. The costs associated with the recommended conservation activities are expected to be modest.

8.3.3 Summary of Future Recreation Impacts

162. Although OHV use, hunting, and fishing are important recreational activities in Arizona, with significance for the Arizona economy, the remote nature of and challenging terrain of the areas proposed for critical habitat do not lend themselves to OHV use or hunting. In fact, several areas are closed to OHV use.¹⁶⁴ In those areas in which OHV use is not restricted, Gila chub conservation activities are unlikely to require changes to OHV activities. Further, fishing for Gila chub in Arizona and New Mexico is prohibited, and most Gila chub populations do not occur in popular fishing areas. Therefore, this analysis does not anticipate large economic impacts to recreation activities from Gila chub conservation activities within the proposed CHD.

163. Based on information gathered from the proposed rule, the consultation history, and during personal communications, it was determined that only 14 of the 30 stream reaches of proposed CHD have recreational access. In the sections that follow, this analysis presents total future economic impacts in the 14 proposed critical habitat area and stream reach with recreational access.

¹⁶² Personal communication with Jerry Monzingo, Fisheries Biologist, Gila National Forest, May 13, 2005.

¹⁶³ U.S. Fish and Wildlife Service. Biological and Conference Opinion Las Cienegas National Conservation Area Resource Management Plan. October 4, 2002.

¹⁶⁴ BLM does not allow OHV use up and down any of the stream reaches within proposed CHD. BLM's default restrictions on public lands are for vehicles to use existing roads and trails. The stream crossings in proposed CHD are roaded and cause little impact. Written communication from Ted Cordery, Endangered Species Coordinator, Bureau of Land Management, Arizona State Office, June 17, 2005.

Area 1: Upper Gila River

- **Turkey Creek:** The Turkey Creek stream reach is located within the Gila Wilderness.¹⁶⁵ The Gila National Forest Plan identifies management of this area as maintaining present natural conditions and providing protection to natural features and vegetative communities while providing opportunities for research and education. The plan also states that dispersed recreation will be managed at low intensity. OHV use is prohibited, and no permits for fuelwood or other products will be issued. There are hot springs along Turkey creek that do receive heavy recreational use at times. In addition, there is a trail within the canyon, however, due to the steep topography of the canyon the trail is located away from the proposed CHD. A very limited amount of fishing occurs along the stream. Therefore, this analysis anticipates that if there are any recreational impacts in the Turkey Creek stream reach they will be modest.

Area 2: Middle Gila River

- **Blue River:** The Blue River is located entirely within the San Carlos Apache Reservation. Impacts to the San Carlos Apache Tribe are described in Section 6.
- **Bonita Creek:** Bonita Creek is partially located within the San Carlos Apache Reservation. Impacts to the San Carlos Apache Tribe are described in Section 6. The remaining area is owned by BLM. Very limited recreation occurs within the portion of Bonita Creek owned by BLM, as access is restricted. Therefore, this analysis does not anticipate recreational impacts in the Bonita Creek stream reach.

Area 4: Lower San Pedro River

- **Hot Springs Canyon:** Although recreational activities occur in Hot Springs Canyon, the amount of recreational use is limited by the rugged terrain and the area's remoteness. OHV use is allowed in the Muleshoe Cooperative Management Area (CMA) on existing roads and trails.¹⁶⁶ However, BLM and The Nature Conservancy (TNC) closed approximately 140 acres of the riparian area of Hot Springs Canyon to OHV use. Visitors also use Muleshoe CMA year-round for hunting, hiking, horseback riding, birding, wildlife observation, and primitive camping. Some of these activities are concentrated around developed campsites, casitas, and nature and hiking trails. Given the

¹⁶⁵ Written communication from Jerry Monzingo, Fisheries Biologist, Gila National Forest, May 13, 2005.

¹⁶⁶ U.S. Fish and Wildlife Service. Conference Opinion for the Proposed Reestablishment of Spikedace, Loach Minnow, Gila Topminnow, Desert Pupfish, and the Augmentation of Gila Chub into Multiple Springs and Streams within the Muleshoe Cooperative Management Area. April 19, 2005.

location and nature of the recreational activities in Hot Springs Canyon, this analysis does not anticipate recreational impacts in the Hot Springs Canyon stream reach.

Area 5: Santa Cruz River

- **Sabino Canyon:** Relative to other areas proposed for critical habitat, heavy recreational use may occur in Sabino Canyon.¹⁶⁷ Sabino Canyon receives 1.3 million visitors per year that come to hike along the road, take rides on a shuttle that goes up and down the canyon on the road, and swim in the creek.¹⁶⁸ The paved road crosses the creek on its way to a trailhead and overlook via ten bridges. The Coronado National Forest is concerned that conservation efforts for the Gila chub may include changes in road maintenance.¹⁶⁹ Delays in road repair or maintenance could reduce the income the USFS collects through visitor fees and the income of the concessionaire who runs the shuttle bus, if changes to the operation of the shuttle service are interrupted, or if visitor use to the area is restricted. The USFS grosses approximately \$350,000 annually in visitor fees, while the concessionaire grosses about \$800,000 annually. However, at this time it is not known what restrictions, if any, may be placed on road repair and maintenance associated with Gila chub conservation efforts, and whether any resulting changes to shuttle operation or USFS visitation will occur.¹⁷⁰ Because sediment removal is likely to provide some benefits to the Gila chub, restrictions on sediment removal, and therefore on shuttle operations and visitor use, appear unlikely. This analysis, therefore, does not anticipate that the USFS or the private concessionaire will be impacted.

Area 6: Upper Verde River

- **Walker Creek:** There is very little recreational use in the Walker Creek area.¹⁷¹ There is one hiking trail along the creek, however, the trail is upland of the creek and does not cross the creek. Therefore, this analysis does not anticipate recreational impacts in the Walker Creek stream reach.

¹⁶⁷ Personal communication with William Werner, Environmental Program Manager, Colorado River Management Section, State of Arizona, Department of Water Resources, May 25, 2005.

¹⁶⁸ Written communication from Joshua Taiz, District Wildlife Biologist, Santa Catalina Ranger District, U.S. Forest Service, June 6, 2005.

¹⁶⁹ Due to the peculiar design of the bridges (designed as culverts in low flow and low-water crossings at moderate flows) and the recent catastrophic fires in the Santa Catalinas, moderate river flows can result in sediment deposition in the roadway. This sediment is usually removed by USFS and the private concessionaire that operates the shuttle bus. If restrictions were placed on this sediment removal, economic impacts could occur. The USFS states that "at this time it is difficult to determine exactly what restrictions would be placed on such maintenance, but it is likely that additional restrictions would impact both public safety (from potential accidents associated with attempting to cross impacted bridges) and economics (when the shuttle decides it can no longer cross sedimented bridges and shuts down operations)." Written communication Josh Taiz, District Wildlife Biologist, Santa Catalina Ranger District, U.S. Forest Service, June 6, 2005.

¹⁷⁰ Written communication from Joshua Taiz, District Wildlife Biologist, Santa Catalina Ranger District, U.S. Forest Service, June 6, 2005.

¹⁷¹ Personal communication with Janie Agyagos, Wildlife Biologist, Coconino National Forest, May 2005.

- **Red Tank Draw:** There is some recreational use in the Red Tank Draw stream reach.¹⁷² Rock art tours are conducted within the Red Tank Draw creek area.¹⁷³ The portion of the stream near the rock art flows is intermittent, only flowing during storm events. Thus, visitors are not required to not cross into water to access to the rock art.¹⁷⁴ The primary recreational activities occur outside of the critical habitat area. Thus, this analysis does not anticipate recreational impacts in the Red Tank Draw stream reach.
- **Spring Creek:** There is some recreational use in the Spring Creek stream reach.¹⁷⁵ The Spring Creek area is available for day use only. Camping is not allowed in the area. There is one low-water crossing in the proposed CHD. This crossing is a concrete cattle guard. Because they must cross on this permanent concrete feature, recreators do not come in contact with the water while crossing. Therefore, this analysis does not anticipate recreational impacts in the Spring Creek stream reach.

Area 7: Agua Fria

- **Little Sycamore Creek:** There is very limited recreational use in the Little Sycamore Creek stream reach.¹⁷⁶ Therefore, this analysis does not anticipate recreational impacts in the Little Sycamore Creek stream reach.
- **Sycamore Creek:** There is very limited recreational use in the Sycamore Creek stream reach.¹⁷⁷ Therefore, this analysis does not anticipate recreational impacts in the Sycamore Creek stream reach.
- **Indian Creek:** Although the Great Western Trail, which is accessible using four wheel drive vehicles, passes by Indian Creek, both sides of Indian Creek are fenced, prohibiting travel through the proposed CHD.^{178,179} Therefore, this analysis does not anticipate recreational impacts in the Indian Creek stream reach.

¹⁷² Personal communication with Janie Agyagos, Wildlife Biologist, Coconino National Forest, May 2005.

¹⁷³ “Rock art” is the generic term for the enigmatic designs early Americans carved and painted into the caves, boulders, and canyon walls. U.S. Forest Service. Accessed at <http://www.fs.fed.us/r3/coconino/news/2000/index.shtml> on June 9, 2005.

¹⁷⁴ Personal communication with Janie Agyagos, Wildlife Biologist, Coconino National Forest, July 20, 2005.

¹⁷⁵ Ibid.

¹⁷⁶ Personal communication with Albert Sillas, Prescott National Forest, May 2005.

¹⁷⁷ Personal communication with Albert Sillas, Prescott National Forest, May 2005.

¹⁷⁸ The Great Western Trail is a 3,000 mile off-pavement touring route following backcountry roads from Mexico to Utah. Arizona State Parks. Accessed at <http://www.pr.state.az.us/tripguide/adventure/wheel.html> on June 8, 2005.

¹⁷⁹ Personal communication with Albert Sillas, Prescott National Forest, June 8, 2005.

- **Silver Creek:** Recreational use is generally low in the Silver Creek stream reach, but has increased since this area was designated a National Monument (Agua Fria National Monument).¹⁸⁰ Recreational use in this stream reach is dispersed, associated primarily with equestrian activities, hunting, hiking, and sightseeing. Therefore, this analysis does not anticipate recreational impacts in the Silver Creek stream reach.
- **Larry Creek:** Recreational use is limited in the Larry Creek stream reach. The topography of Larry Creek is steep canyons; as a result Larry Creek is virtually unaffected by any land uses or human activity.¹⁸¹ Therefore, this analysis does not anticipate recreational impacts in the Larry Creek stream reach.
- **Lousy Creek:** Recreational use at Lousy Creek is similar to Larry Creek (i.e., limited due to the steep topography).¹⁸² It is virtually unaffected by any land uses or human activity. Therefore, this analysis does not anticipate recreational impacts in the Lousy Creek stream reach.

8.4 Impacts on Fire Management Activities

164. 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.¹⁸³ 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.¹⁸⁴
165. 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 exacerbated 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.¹⁸⁵

¹⁸⁰ U.S. Fish and Wildlife Service. Formal conference on the Existing Phoenix Resource Management Plan for the Agua Fria National Monument. July 14, 2004.

¹⁸¹ U.S. Fish and Wildlife Service. Formal conference on the Existing Phoenix Resource Management Plan for the Agua Fria National Monument. July 14, 2004.

¹⁸² U.S. Fish and Wildlife Service. Formal conference on the Existing Phoenix Resource Management Plan for the Agua Fria National Monument. July 14, 2004.

¹⁸³ H.R. 2696, July 10, 2003.

¹⁸⁴ "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.

¹⁸⁵ Ibid.

166. 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.¹⁸⁶ 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).¹⁸⁷ 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 Gila chub and proposed CHD areas. Various agencies and private parties may conduct fire management activities within the proposed CHD.

167. This section is divided into three parts. First, a background discussion of the potential for Gila chub conservation activities to decrease the effectiveness of actions taken to reduce the risk of catastrophic fire to surrounding communities is presented. Second, Wildland-Urban Interface (WUI) data are utilized to identify areas within the proposed CHD where fire management activities are most likely to occur. Third, impacts of fire on Gila chub management are discussed.

8.4.1 Background and Summary of Past Fire Management Impacts

168. Gila chub conservation activities have had limited impacts on fire management activities in the past. However, wildfire itself has affected Gila chub management. Two consultations on fire management have been completed to date that addressed Gila chub. The first consultation was BLM Arizona Statewide Land Use Plan Amendment for Fire, Fuels, and Air Quality Management. The second was completed for prescribed burning efforts on the Agua Fria National Monument.¹⁸⁸ Conservation activities for the Gila chub are described in Exhibit 8-5, but primarily requests to monitor and report findings on the status of the species. Administrative costs and costs related to implementation of these past conservation activities are presented in Section 3.

¹⁸⁶ National Interagency Fire Center, Historical Wildland Fire Statistics, www.nifc.gov/stats/historicalstats.html, accessed February 16, 2004.

¹⁸⁷ Wichner, David. "Rodeo-Chediski Costs Rank 2nd," *Arizona Daily Star*, July 16, 2002.

¹⁸⁸ 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. Formal Conference on the Existing Phoenix Resource Management Plan for the Agua Fria National Monument. July 14, 2004.

Exhibit 8-5

**CONSERVATION ACTIVITIES FOR FIRE MANAGEMENT ASSOCIATED
WITH THE GILA CHUB**

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.
Agua Fria National Monument	No more than one-half of the watershed is to be burned in any two year period.
	Burns can only occur on mesa tops (i.e., canyon slopes and riparian areas will not be burned).
Sources: 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. Formal Conference on the Existing Phoenix Resource Management Plan for the Agua Fria National Monument. July 14, 2004.	

8.4.2 Summary of Future Fire Management Impacts

169. In Gila chub proposed CHD areas, and in many areas across the U.S., the Department of Agriculture 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.”¹⁸⁹ 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.¹⁹⁰

170. 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).¹⁹¹ 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

¹⁸⁹ 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.

¹⁹⁰ “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.

¹⁹¹ “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.

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.¹⁹²

171. Based on an analysis of the WUI data, overlap of the proposed CHD with WUI areas is limited. Approximately 362 acres of WUI areas fall within the proposed CHD across three proposed CHD areas and four stream reaches.¹⁹³ In total, two percent of the acres proposed for CHD overlaps with WUI areas. These WUI areas are only a small fraction of the areas identified as potential WUI areas in the Wisconsin data. The number of acres that overlap WUI areas is presented by Area in Exhibit 8-6.

Exhibit 8-6		
WILDLAND URBAN INTERFACE AREAS IN PROPOSED CHD (HIGHLIGHTING COUNTIES WITH LARGEST WUI OVERLAP)		
CHD Area	Stream Reach	Overlap with WUI (Acres)
Area 2: Middle Gila River Area	Bonita Creek	5
Area 5: Lower Santa Cruz River Area	Cienega Creek	150
	Sabino Canyon	1
Area 6: Upper Verde River Area	Spring Creek	206
Total		362
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		

172. 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." Thus, future informal consultation efforts on fire management activities are expected to be streamlined.¹⁹⁴

¹⁹² "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.

¹⁹³ 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.

¹⁹⁴ "Joint Counterpart Endangered Species Act Section 7 Consultation Regulations," 68 FR No 235, p. 68254, December 8, 2003.

173. Perhaps the most costly effect on fire management activities may be borne by agencies when they attempt to protect Gila chub populations from an ongoing wildfire. In the past, Federal and State agencies have made several attempts to evacuate Gila chub populations when a fire was expected to destroy habitat on public lands.¹⁹⁵ The cost of these evacuations varies 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 \$5,000.¹⁹⁶ After a wildfire moves through an area, the affected Gila chub population must be reestablished. Depending on the severity of the fire, it can take several months to years for the habitat to be restored. Holding the Gila chub in captivity and reestablishment is assumed to be 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.¹⁹⁷ Therefore, the total costs of Gila chub evacuation and reestablishment in the event of a wildfire is 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 Gila chub evacuation and reestablishment costs to stream reaches within the proposed CHD. Past costs of population evacuation and reestablishment are presented in Section 3.
174. Expected impacts on fire management activities include administrative costs related to consultation on fire management plans, as well as cost of evacuation and reestablishment of Gila chub populations in the event of a wildfire. In addition, the overlap of 362 acres of WUI area may pose some increased risk of fire to those and nearby areas.

8.5 Impacts on Mining Activities

175. Although mining plays a significant role in the Arizona economy and is important in the counties containing Gila chub critical, this analysis does not anticipate any impacts to mining from Gila chub conservation activities. The one mine that is within the boundaries of the proposed critical habitat is classified by the Arizona Land Information System as a "devel.deposit," an area where minerals have been found, but excavation has not yet been initiated by the owner.¹⁹⁸

8.5.1 Background on Mining Activities

176. Mining makes significant contributions to the economies of the Counties containing proposed critical habitat. In 2003, the estimated value of non-fuel mineral production in Arizona was \$2.1 billion, of which \$1.35 billion was related to copper

¹⁹⁵ 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.

¹⁹⁶ Evacuating a population is least expensive using a mule or a truck and most expensive using a helicopter.

¹⁹⁷ This analysis assumes the costs holding Gila chub 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.

¹⁹⁸ Arizona Land Information System, Mine Data. "AZMines." Accessed Online on 6/21/2005.

production.¹⁹⁹ Arizona is the leading copper-producing state in the U.S., accounting for nearly two-thirds of total U.S. copper mine production and value. Within the counties containing areas proposed for critical habitat, copper mining is the most important type of mineral extraction activity. There are eight copper mines and two copper plants in Arizona, of which seven mines and both copper plants are located within counties containing proposed critical habitat.²⁰⁰ Mining in the eight counties containing proposed critical habitat represents 72 percent of total employment in the mining industry in Arizona (See Section 2, Exhibit 2-6). Phelps Dodge Corporation produced more than 75 percent of Arizona's copper in 2003, with 50 percent of the state's copper produced at the company's Morenci Mine located in Greenlee county.

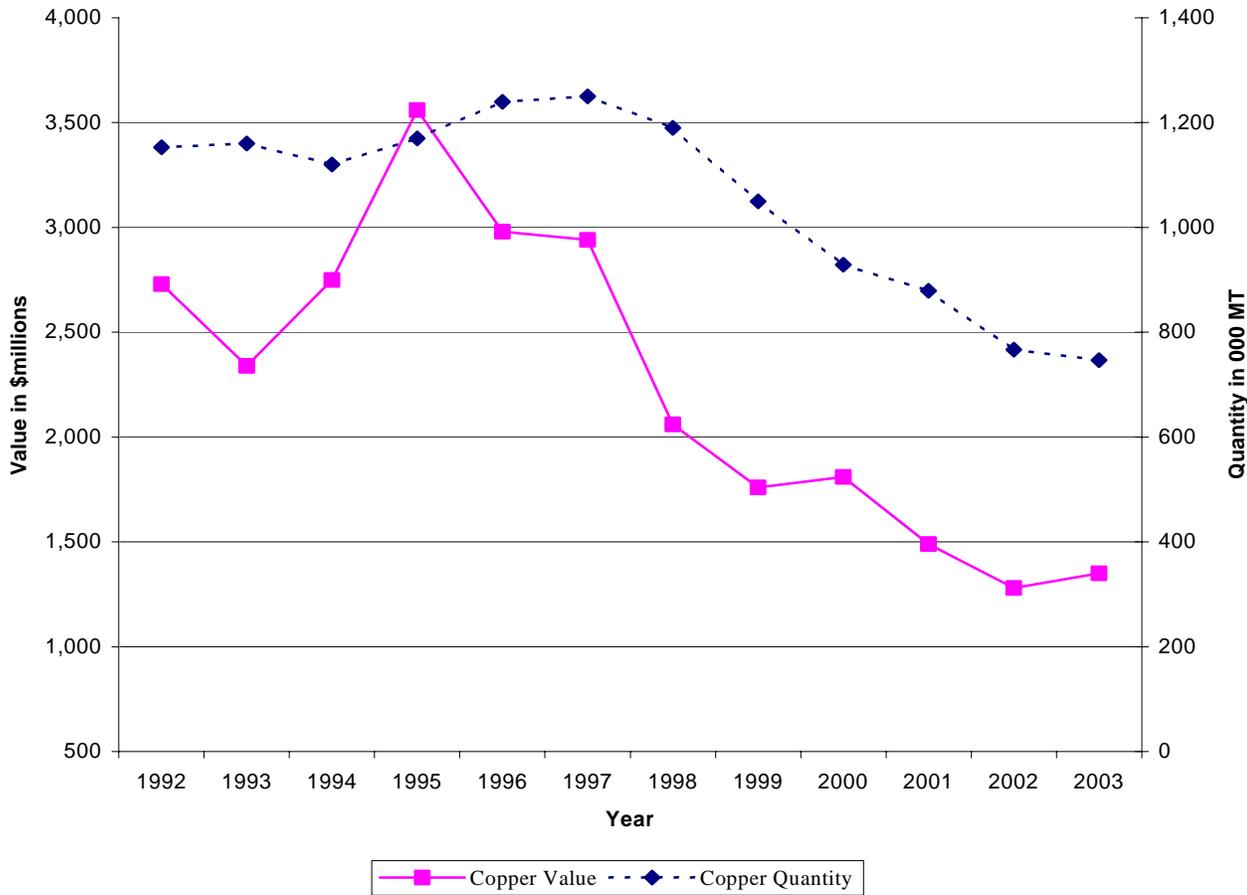
177. Despite its importance to the economy, the copper industry has experienced a period of decline, as Exhibit 8-7 indicates. This trend was influenced in the late 1990 by falling copper prices and increased foreign production. Arizona's copper production declined 4.8 percent in 1998 and fell 7.5 percent in 1999. The value of copper produced had an even more dramatic decline, dropping 29.9 percent in 1998 and 12.1 percent in 1999.²⁰¹ Although the copper market's deterioration has abated, copper production and values have continued to decline at a modest pace.

¹⁹⁹ Based on preliminary U.S.G.S. data. "The Mineral Industry of Arizona." U.S. Geological Survey Minerals Yearbook-2003. <http://minerals.usgs.gov/minerals/pubs/state/az.html>

²⁰⁰ Arizona Department of Mines and Mineral Resources/U.S. Geological Survey (2003). Included in "The Mineral Industry of Arizona." U.S. Geological Survey Minerals Yearbook-2003. <http://minerals.usgs.gov/minerals/pubs/state/az.html>.

²⁰¹ Directory of Active Mines in Arizona: 2000, By K.A. Phillips, N.J. Niemuth, and D. R. Bain, Arizona Department of Mines and Mineral Resources, Directory 48, April 2000; p.1. <http://www.azcu.org/azcumining/index.html>

**Exhibit 8-7
Copper Quantity and Value of Production in Arizona**



8.5.2 Summary of Past Economic Impacts to Mining

178. There have not been any conference opinions or section 7 consultations addressing mining in the areas proposed for CHD. This analysis did not find any past economic impacts on mining resulting from Gila chub conservation activities in the proposed CHD.

8.5.3 Summary of Future Economic Impacts to Mining

179. A considerable amount of Arizona's mining activity takes place in the counties that contain proposed critical habitat for the Gila chub. Only one mine, however, is located in the proposed critical habitat for the Gila chub, with a second mine operated roughly two miles away. The Knapp Group owns the mine in the Mineral Creek stream reach. According to the Arizona Land Information System, this mine is not operational, classified only as having been scoped for mineral deposits. Copper, titanium and

manganese are listed as having been found in this area, but these resources are not currently being extracted.²⁰² Should this mine be developed in the future, impacts related to Gila chub conservation activities may occur. However, information on the likelihood and timing of potential mining activities are not available.

180. According to the comment letter on the proposed critical habitat designation submitted in 2002 by representatives for ASARCO Incorporated, ASARCO's Ray Complex is outside of proposed CHD. The letter states "the reach of Mineral Creek proposed as critical habitat is upstream of ASARCO's Ray Mine. That reach is disconnected from the remainder of Mineral Creek by Big Box Dam. The dam presents an impassable barrier during all but the most severe flood events."²⁰³ Thus, as this mine is outside and downstream of proposed CHD, impacts are not estimated in this analysis.

8.6 Impacts on Transportation Activities

181. Roads construction and maintenance can adversely affect Gila chub habitat.²⁰⁴ The primary problem related to road construction and maintenance 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.
182. Approximately six roads cross the proposed critical habitat nine times. These roads and the units in which they are contained are presented in Exhibit 8-8.

²⁰² Arizona Land Information System, Mine Data. "AZMines." Accessed Online on 6/21/2005.

²⁰³ Comment letter submitted by the Law Offices of Fennemore Craig on behalf of Arizona Cattle Growers' Association, Phelps Dodge Corporation, ASARCO Incorporated, the Central Arizona Water Conservation District, and Horner Mountain LLC to the U.S. Fish and Wildlife Service on the Proposed Rule to list and designate critical habitat for the Gila Chub dated October 8, 2002.

²⁰⁴ U.S. Fish and Wildlife Service. Proposed Rule to List the Gila Chub as Endangered With Critical Habitat. (67 FR 51948) August 9, 2002.

Exhibit 8-8

ROAD CROSSINGS WITHIN THE PROPOSED CHD FOR THE GILA CHUB

Area	Stream reach	Road	Number of Crossings
Area 3: Babocomari River ^a	O'Donnell Canyon	State Highway 83	1
	Turkey Creek	State Highway 83	1
Area 5: Lower Santa Cruz River ^a	Cienega Creek	Colossal Cave Road	1
		Marsh Station Road	2
Area 6: Upper Verde River ^a	Red Tank Draw	National Forest 618 Road	1
	Walker Creek	National Forest 618 Road	1
	Spring Creek	State Highway 89A	1
Area 7: Agua Fria River ^b	Silver Creek	Unimproved	1
Total			9

Sources:

^a GIS analysis performed by IEc. GIS data for roads in Arizona were intersected with Gila chub critical habitat. Source: ESRI, Arizona road GIS data "azrds", 2001; Gila chub critical habitat GIS layer, Service, May 2005.

^b U.S. Fish and Wildlife Service. Formal Conference on the Existing Phoenix Resource Management Plan for the Agua Fria National Monument. July 14, 2004.

8.6.1 Summary of Past Economic Impacts on Transportation Activities

183. No conference opinions or section 7 consultations addressing road construction or maintenance projects impacting the Gila chub have occurred in the areas proposed for CHD. This analysis did not find any past economic impacts on transportation resulting from Gila chub conservation activities in the proposed CHD.

8.6.2 Summary of Future Economic Impacts on Transportation Activities

184. While no impacts on road and bridge construction associated with the Chub have occurred in the past, this analysis forecasts some costs from 2005 to 2025, based on the following assumptions:

- Two road or bridge construction or maintenance projects will occur associated with each road crossing within the 20-year time frame.²⁰⁵ That is, 16 projects will be impacted by Gila chub conservation activities, four on Forest Service roads and 12 on non-Forest Service roads. No maintenance of the unimproved crossing on the Aqua Fria Monument is expected.²⁰⁶
- Each of the projects will require either an informal to a formal consultation. Total administrative costs for transportation activities in the future, therefore, range from the cost of 16 informal to 16 formal consultations (administrative costs are discussed in Appendix A).

²⁰⁵ This analysis assumes maintenance projects will occur every 10 years.

²⁰⁶ The proposed CHD at this crossing consists of a bedrock channel where water is shallow or absent. U.S. Fish and Wildlife Service. Formal Conference on the Existing Phoenix Resource Management Plan for the Agua Fria National Monument. July 14, 2004.

- The conservation activities for the Gila chub are anticipated to be similar to those implemented for other endangered fish species. BLM completed a conference opinion on the impact of a construction project on a section of Bull Gap Run Road downstream from the Bonita Creek stream reach on endangered fish species. The project proposed to construct a new 1,350-foot section of road in order to provide public access to Gila Box Riparian National Conservation Area and other public land. This construction allowed users to bypass an old 3,100-foot section of road which crossed the creek. The Service requested that BLM implement several conservation activities, including the construction of straw bale barriers to catch and hold any excess sediment, best management practices for road work and hazardous materials containment, and an education program for employees before work begins on the effects of road construction on fish and water quality.²⁰⁷ This analysis assumes that similar measures will be required during road construction or maintenance within the proposed critical habitat for Gila chub.
- The costs of conservation activities conducted by the Arizona Department of Transportation and Forest Service, which have completed consultations and undertaken conservation activities for endangered fish species, are presented in Exhibit 8-9. This analysis assumes that the costs of Gila chub conservation activities will be similar to those incurred by the Arizona Department of Transportation and the Forest Service.

Exhibit 8-9		
CONSERVATION ACTIVITIES FOR TRANSPORTATION ACTIVITIES ASSOCIATED WITH OTHER THREATENED AND ENDANGERED FISH IN ARIZONA AND NEW MEXICO		
Agency	Conservation Activity	Cost
Arizona Department of Transportation ^a	Remove fish from the impact area prior to and during diversion	\$8,000
	Remove fish from impact area under a bridge	\$8,000
	Remove fish from a pool below the highway	\$3,000
	Survey and remove fish and monitor pre- and post-project	\$15,000
	Remove fish from a large pool under a bridge	\$3,000
	Remove fish from a drying pool	\$2,000
	Potential Project Cost Range	\$2,000-\$15,000
Forest Service Apache-Sitgreaves National Forest ^b	Work outside of stream	
	Buffer against sedimentation with silt aprons	
	Potential Project Cost Range	\$1,500-\$50,000
Sources:		
^a Written communication from Melissa Maiefski, Arizona Department of Transportation, October 15, 2002.		
^b Personal communication with Terry Myers, U.S. Forest Service, Apache-Sitgreaves National Forest, District Ranger, October 2002.		

²⁰⁷ U.S. Fish and Wildlife Service. Conference Opinion for the New Bull Gap Road Section Project, Gila Box Riparian National Conservation Area (RNCA), Graham County, Arizona. December 4, 2003.

- This analysis estimates that conservation activity costs associated with non-Forest Service road construction or maintenance will range from \$2,000 to \$15,000 per project.
- This analysis estimates that conservation activity costs associated with Forest Service road construction or maintenance will range from \$2,000 to \$15,000 per project.

This analysis estimates that the total costs of consultations and conservation activities associated with road and bridge construction and maintenance may range from \$86,000 to \$737,000 over the next 20 years (undiscounted dollars). Total road and bridge construction and maintenance costs are presented by stream reach in Exhibit 8-10.

Exhibit 8-10

**ESTIMATED FUTURE COSTS ASSOCIATED WITH ROAD AND BRIDGE CONSTRUCTION AND MAINTENANCE
IN GILA CHUB PROPOSED CHD**

Area	Stream Reaches	Total Projects	Administrative Costs ^a		Conservation Activity Costs		Total Undiscounted Dollars		Present Value (3%)		Present Value (7%)	
			Low	High	Low	High	Low	High	Low	High	Low	High
Area 3 Babocomari River	O'Donnell Canyon	2	\$7,000	\$45,000	\$4,000	\$30,000	\$11,000	\$75,000	\$8,200	\$56,000	\$60,000	\$40,000
	Turkey Creek	2	\$7,000	\$45,000	\$4,000	\$30,000	\$11,000	\$75,000	\$8,200	\$56,000	\$6,000	\$40,000
	Subtotal	4	\$14,000	\$89,000	\$8,000	\$60,000	\$22,000	\$149,000	\$16,400	\$111,000	\$12,000	\$79,000
Area 5 Lower Santa Cruz River	Cienega Creek	6	\$21,000	\$134,000	\$12,000	\$90,000	\$33,000	\$224,000	\$24,500	\$167,000	\$18,000	\$119,000
	Subtotal	6	\$21,000	\$134,000	\$12,000	\$90,000	\$33,000	\$224,000	\$24,500	\$167,000	\$18,000	\$119,000
Area 6 Upper Verde River	Walker Creek	2	\$7,000	\$45,000	\$3,000	\$100,000	\$10,000	\$145,000	\$7,400	\$108,000	\$5,000	\$77,000
	Red Tank Draw	2	\$7,000	\$45,000	\$3,000	\$100,000	\$10,000	\$145,000	\$7,400	\$108,000	\$5,000	\$77,000
	Spring Creek	2	\$7,000	\$45,000	\$4,000	\$30,000	\$11,000	\$75,000	\$8,200	\$56,000	\$6,000	\$40,000
	Subtotal	6	\$21,000	\$133,800	\$10,000	\$230,000	\$31,000	\$364,000	\$23,100	\$271,000	\$16,000	\$193,000
Total		16	\$56,000	\$357,000	\$30,000	\$380,000	\$86,000	\$737,000	\$64,000	\$548,000	\$46,000	\$390,000

^a Administrative costs are discussed in Appendix A.

Note: Totals may not sum due to rounding.

APPENDIX A: ADMINISTRATIVE COSTS

A.1 Categories of Administrative Costs

185. This appendix provides an overview of the categories of administrative costs impacts that arise due to the implementation of section 7 for the Gila chub.

Technical Assistance

186. 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 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 Gila chub. 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 may occur with Federal, State, or local agencies, or private stakeholders.

Section 7 Consultations

187. 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. 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.
188. 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 proposed activity, the Federal agency, and whether there is a private applicant involved.

189. Section 7 consultations with the Service may be either informal or formal. *Informal consultations* consist of discussions between the Service, the Action agency, and the applicant concerning an action that may affect a listed species or its designated critical habitat, 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

190. 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.

191. The administrative cost estimates presented in this Section take into consideration the level of effort 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 consultation, such as the cost of time spent in meetings, preparing letters, and the development of a biological opinion. Exhibit A-1 summarizes the estimated administrative costs of consultations and technical assistance requests.

Exhibit A-1

**ESTIMATED ADMINISTRATIVE COSTS OF CONSULTATION AND
TECHNICAL ASSISTANCE EFFORTS (PER EFFORT)^a**

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 - \$4,100	\$4,000 - \$5,600
Programmatic Consultation	\$11,500 - \$16,100	\$9,200 - \$13,800	\$0	\$5,600

Sources: IEC analysis based on data from the Federal Government General 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.

APPENDIX B: SMALL BUSINESS AND ENERGY IMPACTS ANALYSES

192. 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 Regulatory Flexibility Act (RFA) as amended by the Small Business Regulatory Enforcement Fairness Act (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 A.2 is conducted pursuant to Executive Order No. 13211.

B.1 SBREFA Analysis

193. 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).²⁰⁸ 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.²⁰⁹ 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.

194. To assist in this process, the following represents a screening level analysis of the possible effects of the designation of conservation activities for the Gila chub 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 Gila chub conservation activities, and then details and quantifies the specific impacts to potentially affected small businesses.

²⁰⁸ 5 U.S.C. 601 et seq.

²⁰⁹ 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).

B.1.1 Identification of Activities That May Involve Small Entities

195. This analysis estimates prospective economic impacts due to implementation of Gila chub conservation activities in nine categories:

1. Water management and use;
2. Livestock grazing activities;
3. San Carlos Apache Tribal activities;
4. Residential and related development;
5. Gila chub specific management activities;
6. Recreation activities;
7. Fire management activities;
8. Mining; and
9. Transportation.

196. In six of these nine categories, impacts of Gila chub conservation are not anticipated to impact small businesses for the following reasons:

- *Residential and related development:* Section 7 of this analysis discusses the potential impacts of Gila chub conservation activities on residential and related development within the proposed CHD. As discussed in Section 7, costs related to development activities are unlikely in proposed CHD. As a result, impacts on small entities are also unlikely.
- *Gila chub specific management:* Section 8 of this analysis presents the potential costs of Gila chub specific management activities. Gila chub specific conservation activities may cost between \$1.2 million and \$2.2 million (undiscounted dollars) over the next 20 years. As BLM, USFS, and Arizona Game and Fish Department (AZGFD) are expected to bear these costs, no impacts on small entities are anticipated for this category.
- *Recreation activities:* Section 8 of this analysis discusses the potential impacts of Gila chub conservation activities on recreation activities within the proposed CHD. No costs are estimated in Section 8. In Sabino Canyon delays in road repair or maintenance could reduce the income the USFS collects through visitor fees and the income of a concessionaire who runs the shuttle bus. However, at this time it is not known what restrictions may be placed on road repair and maintenance associated with Gila Chub conservation efforts.²¹⁰ This analysis, therefore, does not expect USFS or the private concessionaire will be impacted. Modest recreational impacts may occur in the Turkey Creek stream reach in Area 1: Upper Gila River. Any costs are expected to be borne by the U.S. Forest Service (USFS). As a result, impacts on small entities are not anticipated for this category.

²¹⁰ Written communication from Joshua Taiz, District Wildlife Biologist, Santa Catalina Ranger District, U.S. Forest Service, June 6, 2005.

- *Fire management activities:* Section 8 of this analysis discusses the potential impacts of Gila chub conservation activities on fire management activities within the proposed CHD. 362 acres of the proposed CHD fall within WUI areas. However, any increased costs of fire management are expected to be borne by the county, state, and federal agencies, suggesting that impacts on small entities related to fire management activities are unlikely.
- *Mining:* Section 8 of this analysis discusses the potential impacts of Gila chub conservation activities on mining within the potential CHD. One future mining operation may be impacted by Gila chub conservation activities, although the mining claim is inactive. Consequently, as discussed in Section 8, no impacts are anticipated on mining activities related to Gila chub conservation measures, and impacts on small mining businesses are unlikely.
- *Transportation:* Section 8 of this analysis presents the potential costs to transportation activities. Gila chub specific conservation activities may cost \$86,000 to \$737,000 (undiscounted dollars) in the next 20 years. These costs are expected to be borne by the USFS and the Arizona Department of Transportation. Therefore, this category of impacts is not expected to cause impacts on small entities.

The remaining portion of the SBREFA screening analysis contained in this appendix focuses on economic impacts to the livestock grazing and water management industries.

B.1.2 Analysis of Impacts to San Carlos Apache Tribe

197. Section 6 of this analysis details the potential impacts of Gila chub conservation activities on the San Carlos Apache Tribe. The EPA has noted that, "for the purposes of the RFA, States and Tribal governments are not considered small governments but rather as independent sovereigns."²¹¹ Tribal enterprises, like other enterprises, can be considered small entities under RFA/SBREFA.²¹² The economic analysis estimates that future impacts resulting from Gila chub conservation activities on Tribal lands could include administrative costs of consultations, surveys and monitoring, development of a final Fisheries Management Plan, modifications to grazing, timber harvesting, fire management, and recreation activities, and potential project modifications to restoration activities. Impacts in each of these areas could affect the Tribe's revenues and employment in the future.

²¹¹ EPA. "Regulatory Flexibility Act/Small Business Regulatory Enforcement Fairness Act (RFA/SBREFA). What is a "small government?" Accessed at <http://www.epa.gov/sbrefa/government.htm> on August 10, 2005.

²¹² The Small Business Size Regulations state that "Business concerns owned and controlled by Indian Tribes, Alaska Native Corporations (ANCs) organized pursuant to the Alaska Native Claims Settlement Act (43 U.S.C. 1601 *et seq.*), Native Hawaiian Organizations (NHOs), Community Development Corporations (CDCs) authorized by 42 U.S.C. 9805, or wholly-owned entities of Indian Tribes, ANCs, NHOs, or CDCs are not considered affiliates of such entities. Small Business Size Regulations, Title 13: Business Credit and Assistance, Chapter I: Small Business Administration, Part 121: Small Business Size Regulations.

Quantified impacts to livestock grazing activities are estimated to range from \$22,000 to \$306,000 annually using a seven percent discount rate (\$18,000 to \$274,000 discounted at three percent), or between one percent and 57 percent of annual revenues to each of three livestock associations, which are assumed to be small for the purposes of this analysis.²¹³

198. Quantified impacts of reduced lumber production are estimated to be approximately \$15,000 annually. These impacts could be borne by a Tribally-owned timber mill, a private leasee of the mill, and /or a small logging contractor. There are 25 forestry and logging companies in Arizona.²¹⁴

B.1.3 Analysis of Impacts to Small Businesses Related to Water Management and Use

199. Two water supply entities and the BLM could potentially be impacted by conservation activities related to water supply for the Gila chub. Of these, the City of Safford, Arizona and Vail Water Company are small entities.²¹⁵ The Vail Water Company is one of 33 water supply and irrigation companies in the Pima County, of which 32 are small entities.²¹⁶ The annualized cost of the replacement water to Vail Water Company is between \$73,000 and \$171,000, discounted at three and seven percent, over 20 years (using high-end estimates of water replacement needs). At the high-end, potential annual costs related to Gila chub conservation activities exceed annual revenues (\$99,000). However, as discussed in Section 4, it is important to note that Vail Water Company does not draw water from the well potentially impacted by the proposed Gila chub CHD because it is not potable without treatment, and thus the water rights assumed to be replaced are not currently in use. The Company plans on meeting future increases in water demand by drawing on other existing wells or drilling new wells rather than relying on the well in proposed CHD, thus reducing the likelihood of a need for water rights replacement in CHD areas. In addition, the Sonoran Desert Conservation Plan and Pima County may attempt to purchase the Vail Water Company well in question as part of an effort to restore streamflow in Cienega Creek. Thus, the company may be partially compensated for the replacement of these water rights regardless of Gila chub CHD. Therefore, it is difficult to estimate impacts on the Vail Water Company without knowing the actual out-of-pocket costs related to Gila chub conservation activities or any potential off-setting compensation from selling the well.

²¹³ Revenue data for the livestock associations for 2004 was reported by Dialog search of File 516, Dun and Bradstreet, "Duns Market Identifiers." August 16, 2005.

²¹⁴ County business patterns data for NAICS codes 113, "Forestry and logging", <http://censtats.census.gov/cgi-bin/cbpnaic/cbpdetl.pl>. Accessed on August 18, 2005.

²¹⁵ The Vail Water Company had sales in 2004 of \$99,000 and serves a population of 5,415 customers. The small business standard for NAICS 221310 (Water Supply and Irrigation Systems) is \$6 million. The City of Safford has a population of 9,232 (<http://www.saffordeconomicdevelopment.com/exec/eCommunityProfileStats.asp>). The small government standard is less than 50,000 residents. Size standards based on SBA's Table of Small Business Size Standards based on NAICS 2002, accessed at <http://www.sba.gov/size/indextableofsize.html>.

²¹⁶ Dialog search of File 516, Dun and Bradstreet, "Duns Market Identifiers." Small businesses were determined based on the SBA size standard of \$6 million in revenues for NAICS code 22131, "Water Supply and Irrigation Systems."

200. The annualized cost of the replacement water to the City of Safford is between \$287,000 and \$669,000, discounted at three and seven percent over 20 years (using high-end estimates of water replacement needs). Data on the City's current overall budget is unknown. However, before February 2005 the City's utilities were managed by Gila Resources, Incorporated, a private company dedicated to the City of Safford's utilities. In 2004, Gila Resources reported annual sales of \$12.5 million, more than double the small business threshold of \$6.0 million for NAICS 551112 (Offices of Other Holding Companies).

201. Exhibit B-1 presents the potential impacts of Gila chub conservation activities on the water supply industry. Should these entities either be required or feel compelled to replace current water holdings in proposed CHD, annualized impacts could represent approximately 2.3 to 5.3 percent of annual revenues to the City of Safford's utilities department, and between 74 and 174 percent of annual revenues to the Vail Water Company.²¹⁷

Exhibit B-1					
POTENTIAL IMPACTS OF GILA CHUB CONSERVATION ACTIVITIES ON THE WATER SUPPLY INDUSTRY					
Entity	Small Entity?	Water Replacement Costs (undiscounted dollars, in perpetuity)	Water Replacement Costs, Annualized (20 years, 3%)	Water Replacement Costs, Annualized (20 years, 7%)	Annual Revenues
City of Safford (Gila Resources, Inc.)	Yes (no)	\$9.6 million	\$287,000	\$669,000	Unknown (\$12.5 million)
Vail Water Company	Yes	\$2.4 million	\$73,000	\$171,000	\$99,000 ^a

^a Based on a Dialog search of file 516 Dun and Bradstreet, "Dun's Market Identifiers," updated in January 2004.

²¹⁷ The Service expects to work with water users to maintain a minimum adequate streamflow for the Gila chub. Furthermore, at the Bonita Creek proposed CHD area, the Service believes that the City of Safford's infiltration gallery at the lower boundary of proposed CHD is actually a benefit to the Gila chub by acting as a barrier to the movement of nonnative species upstream. As such, the Service believes the scenario involving dramatic reductions in water usage is unlikely, which would necessarily result in reductions in potential impacts.

B.1.4 Analysis of Impacts to Small Businesses Related to Livestock Grazing

202. Ranching operations are anticipated to be impacted by conservation activities for the Gila chub. Approximately 16 ranching operations may be impacted annually, or 0.5 percent of ranches in the affected counties.²¹⁸ Annual costs to each of these 16 ranching operations may be between \$1,400 and \$11,700. Average revenues of a ranch in the proposed CHD region are \$144,000. These potential losses represent between one and eight percent of each ranch's estimated average revenues. Exhibit B-2 presents the average revenues of ranches by county.

Exhibit B-2			
AVERAGE REVENUES OF RANCHES WITHIN THE PROPOSED CHD FOR GILA CHUB			
County	Total Calf Sales	Number of Ranches	Average Revenues
Cochise	\$20,481,000	467	\$43,857
Gila	\$2,231,000	106	\$21,047
Graham	\$3,802,000	123	\$30,911
Greenlee	\$2,066,000	79	\$26,152
Pima	\$7,303,000	185	\$39,476
Pinal	\$199,126,000	226	\$881,088
Santa Cruz	\$5,288,000	109	\$48,514
Yavapai	\$15,411,000	263	\$58,597
Average	\$31,964,000	195	\$143,705
Arizona	\$403,959,000	2,838	\$156,186

Source: National Agriculture Statistical Service. 2002 Census of Agriculture Volume 1, Chapter 2: Arizona County Level Data, 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 June 24, 2005.

203. Of the 118 beef cattle ranching and farming operations (NAICS 112111) in Arizona counties with Gila chub CHD, 92 percent are considered small businesses. Therefore, 15 small ranching operations (92 percent of 16 operations) may experience a reduction in revenues of between one and eight percent annually. The extent to which these impacts are significant to any of these ranching operations will depend on the individual financial conditions of the ranch.

B.2 Potential Impacts to the Energy Industry

204. 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

²¹⁸ 16 BLM and USFS grazing allotments fall within the proposed CHD. BLM states that approximately 10 ranches hold permits to the 13 allotments that cross CHD. Written communication with Ted Cordery, Arizona State Office, BLM, on July 20, 2005. To be conservative, this analysis assumes that each allotment is grazed by one ranching operation.

the supply, distribution, and use of energy.”²¹⁹ The Office of Management and Budget’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.²²⁰

205. As none of these criteria is relevant to this analysis, energy-related impacts associated with Gila chub conservation activities within the proposed CHD are not expected.

²¹⁹ 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>.

²²⁰ Ibid.

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