Appendix L

Fish and Wildlife Coordination Act Report

United States Department of the Interior

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Memorandum

To: Area Manager, Bureau of Reclamation, Western Colorado Area Office, Grand Junction, Colorado

From: State Supervisor, U.S. Fish and Wildlife Service, Albuquerque, New Mexico

Subject: Final Fish and Wildlife Coordination Act Report for the Modified Operations of Navajo Dam and Reservoir, Colorado and New Mexico

Attached is the Final Fish and Wildlife Coordination Act Report (CAR) for the Modified Operations of Navajo Dam and Reservoir as proposed by the Bureau of Reclamation. The proposed project would provide releases to mimic a natural hydrograph to conserve two federally listed species, Colorado pikeminnow (*Ptychocheilus lucius*) and razorback sucker (*Xyrauchen texanus*), in Montezuma County, Colorado, San Juan County, New Mexico, and San Juan County, Utah.

This report has been prepared by the U.S. Fish and Wildlife Service, New Mexico Ecological Services Field Office, under the authority of and in accordance with the requirements of Section 2(b) of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-667e).

Joy E. Nicholopoulos

Attachment

Fish and Wildlife Coordination Act Report
for
Navajo Reservoir Operations

Rio Arriba and San Juan Counties, New Mexico
Archuleta and Montezuma Counties, Colorado
San Juan County, Utah

Submitted to:

U.S. Bureau of Reclamation
Grand Junction, Colorado

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May 30, 2003

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Introduction

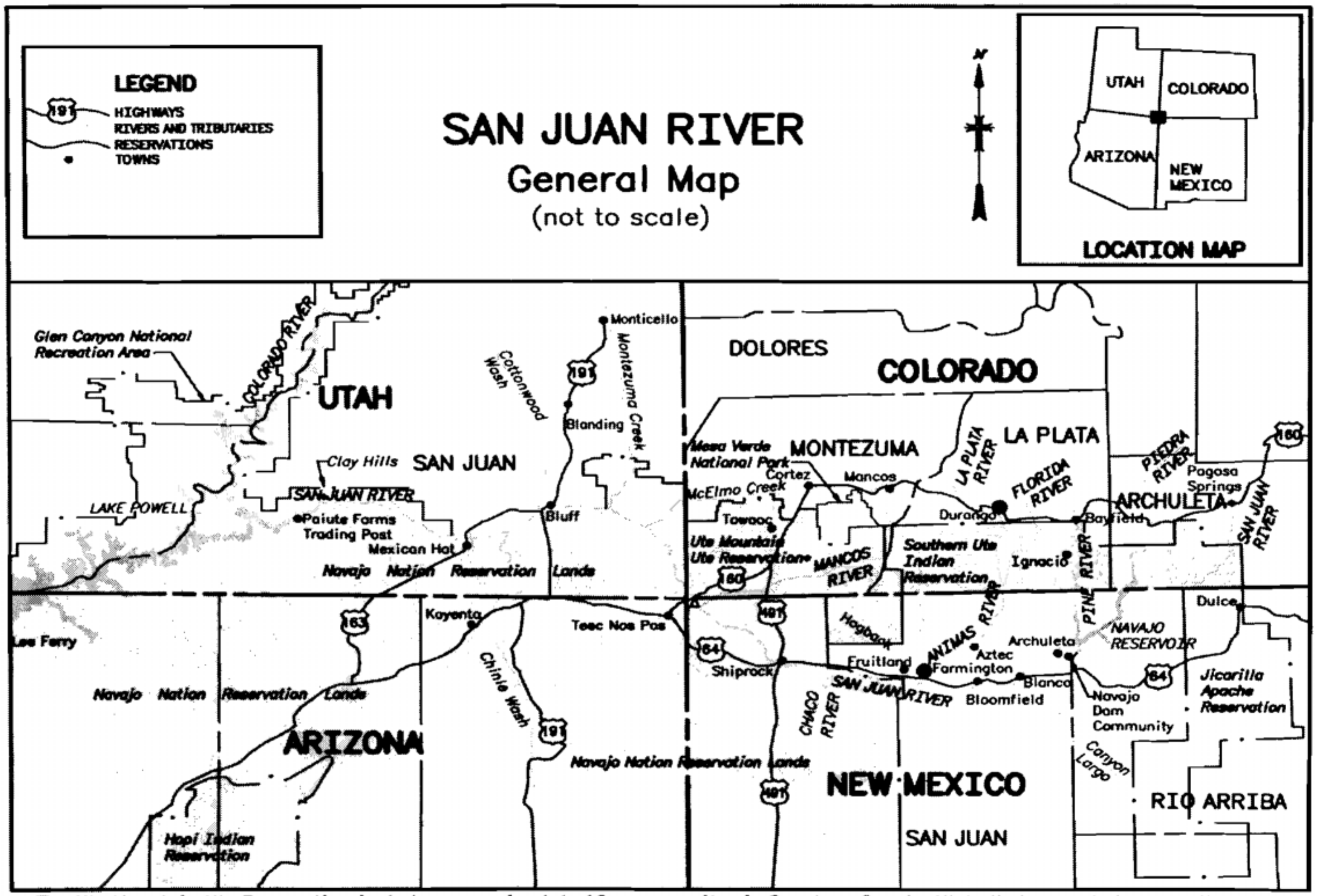
This is a Fish and Wildlife Coordination Act Report (CAR) for the Navajo Reservoir Operations project and has been prepared by the U.S. Fish and Wildlife Service (Service) under the authority of and in accordance with the requirements of Section 2(b) of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 USC 661-667e). This report addresses the flow recommendations for the San Juan River as proposed by the San Juan River Basin Recovery Implementation Program (SJRBRIP) and the alternatives as developed by the U.S. Bureau of Reclamation (Bureau). This report describes fish and wildlife resources existing without the project, potential project impacts to fish and wildlife resources, a discussion of the potential benefits and concerns related to fish and wildlife resources, and recommendations (mitigation) to decrease adverse effects and maximize benefits to fish and wildlife resources.

The Bureau is proposing to implement endangered species-related flow recommendations on the San Juan River for the recovery of two endangered fish species. The proposed action is part of the SJRBRIP goal to conserve populations of Colorado pikeminnow (formerly Colorado squawfish) (*Ptychocheilus lucius*) and razorback sucker (*Xyrauchen texanus*). The purpose of the SJRBRIP flow recommendation is to "protect and recover endangered fishes in the San Juan River while water development continues in compliance with all applicable Federal and state laws" (Service 1995a). The proposed action is designed to mimic a "natural" hydrograph with the volume of water released from Navajo Dam, Rio Arriba County, New Mexico, during spring runoff linked to the amount of precipitation during the preceding winter. The project area extends approximately 224 miles (mi) (360 kilometers) (km) along the San Juan River from Navajo Reservoir, Archuleta County, Colorado, to the confluence with Lake Powell, San Juan County, Utah (figure 1).

The SJRBRIP was initiated in 1992 following consultation with the Service pursuant to section 7 of the Endangered Species Act (Act) on the Animas-La Plata Project (ALP) and the Navajo Indian Irrigation Project (NIIP) in 1991. This consultation lead to a 7-year research period funded by the Bureau and the Bureau of Indian Affairs (BIA). The research is part of a proposed 15-year recovery program for the two species and concluded in 1998. The research and recovery actions were conducted by a multiagency group that included the Service, the New Mexico Department of Game and Fish (NMDGF), Bureau, BIA, Utah Division of Wildlife Resources (UDWR), Bureau of Land Management (BLM), National Park Service (NPS), Southern Ute Indian Tribe, Jicarilla Apache Tribe, Ute Mountain Ute Tribe, Navajo Nation, University of New Mexico (UNM), and other organizations.

Description of Study Area

The San Juan River is a tributary to the Colorado River and drains 38,300 mi^2 (99,200 km^2) in Colorado, New Mexico, Utah, and Arizona (figure 1). From its origins in the San Juan Mountains of southwestern Colorado (at an elevation exceeding 13,943 ft) (4,250 m), the river flows westward through New Mexico, Colorado, and into Lake Powell, Utah. The majority of surface water for the 345 mi (570 km) of river is from the mountains of Colorado. From a water resources perspective, the area of influence for the project begins at the inflow



**The Ute Mountain Ute Reservation includes approximately 10 square miles in San Juan County, Utah, that are not shown on the map.*

Figure 1.—Location map of the Navajo Reservoir Operations project area (provided by the Bureau of Reclamation).

areas of Navajo Reservoir, and extends west from Navajo Dam approximately 224 mi (359 km) along the San Juan River to Lake Powell. The pre-dam median annual discharge near Bluff, Utah, was 1,620,000 acre-feet (ac-ft) (199,826 hectare-meters (ha-m)) with a range of 618,000 ac-ft (76,230 ha-m) to 4,242,000 ac-ft (523,248 ha-m) (Bliesner and Lamarra 2000). The major perennial tributaries in the project area are the Los Pinos, Piedra, Navajo, Animas, La Plata, and Mancos Rivers, and McElmo Creek. There are also numerous ephemeral arroyos and washes that contribute little flow to the San Juan River, but large sediment loads.

Little is known about the historic condition of the San Juan River in northern New Mexico and southern Utah prior to the 1880s. However, during the past 120 years the San Juan River has undergone a variety of changes. Between 1883 and 1890 major watershed erosion contributed large quantities of sediment that moved through the Colorado River drainage including the San Juan River. In the early 1940s sediment inflow and outflow to the San Juan River was reduced (Thompson 1982). Theories for the change in sediment flow include climate change (Bryan 1925), invasion of tamarisk (Graf 1987), or the natural evolution of land forms (Gellis et al. 1991).

The San Juan River is typical of most rivers in the southwestern U.S., characterized by large flows during spring runoff, followed by low but variable summer, fall, and winter base flows. Stream gage data in the San Juan River are inconsistent and incomplete prior to 1929. However, by 1870 there was substantial diversion of water (about 16 percent of natural discharge) for irrigation, primarily during summer months (Bliesner and Lamarra 2000). Between 1929 and 1961 mean daily flows ranged from near 0 to 70,000 cubic feet per second (cfs) (0 to 1,982 cubic meters per second) (cms) near Bluff, Utah. The median daily peak discharge during spring runoff was 10,500 cfs (297 cms), with a range of 3,810 to 33,800 cfs (108 to 957 cms). An average annual hydrograph (USGS Bluff, Utah Gage Station) for the river below Navajo Dam shows that the seasonal peak runoff usually occurred March through July. Mean monthly base flows were as low as 65 cfs (2 cms).

Navajo Dam was completed and began operation in 1963. Navajo Reservoir is used for flood control, water storage, conservation, and irrigation (City of Farmington 1983). The total capacity for the reservoir at spillway crest elevation (6,085 ft) (1,855 m) is 1,708,600 ac-ft (210,755 ha-m). Regulation from Navajo Dam reduced mean peak spring flows by 54 percent, but increased base flows by 285 percent (250 versus 65 cfs) (7 versus 2 cms) (Bliesner and Lamarra 2000). Completion of the reservoir isolated the upper 77 mi (124 km) of river, while the filling of Lake Powell in the early 1980s inundated the lower 54 mi (87 km). The dam is operated and maintained by the Bureau.

Between 1962 and 1991 Navajo Dam was operated to provide stable flows for water storage in a manner that reduced peak spring discharge and elevated flows in other seasons (Bliesner and Lamarra 2000). Since 1992, Navajo Dam has been operated to mimic a natural hydrograph with the volume of release during spring linked to the amount of preceding winter precipitation. An average annual hydrograph (USGS Bluff, Utah Gage Station) for the river below Navajo Dam shows that the seasonal peak runoff during the research period usually occurred in May and June. Average monthly discharges at Bluff range from approximately 476 to 8,749 cfs (14 to 248 cms). The average winter base flow of approximately 500 cfs (14 cms) usually persists from November through February and average flows during the irrigation season (post runoff) (August through October) are typically 500 cfs (14 cms) and supplemented by summer storm events.

The environmental consequences of dam operations and main stem diversions include the narrowing and incising of the river channel, the loss of native wetland and riparian vegetation, changes in water temperature, and blockage or limiting of fish passage. The Animas River ameliorates many of the impacts of dam operations in the San Juan River downstream of their confluence. The incised channel and dam operations limit overbank flows and periodic scouring of floodplain areas. The changed hydrology largely precludes natural regeneration of native cottonwoods and willows and promotes the growth of non-native vegetation such as salt cedar and Russian olive, which have largely replaced the native cottonwood/willow vegetative complex. Prior to 1962 there was no mention of Russian olive in survey notes along the San Juan River. Russian olive and salt cedar now account for more than 85 percent of the riparian vegetation along the San Juan River (Bliesner and Lamarra 2000). Cumulatively, these changes have altered aquatic habitat and its ability to support a healthy native fish community.

Project Description

Proposed Action

The Bureau proposes to implement endangered species-related flow recommendations on the San Juan River in the Four Corners area for endangered fish recovery. The purpose of the proposed action is to provide releases to mimic the natural hydrograph of the San Juan River for the conservation of populations of the endangered Colorado pikeminnow and razorback sucker, while maintaining the authorized purposes of the Navajo Unit, Colorado River Storage Project (CRSP). Conservation of the endangered fish is consistent with the recovery goals established under the Endangered Species Act, 16 U.S.C. 1531 et seq. A Final Environmental Impact Statement (EIS) for the project is being prepared by the Bureau and is planned to be completed spring of 2003.

Background

The Navajo Unit, hereafter referred to as Navajo Reservoir Operation, located in Colorado and New Mexico, was authorized by Congress in 1956 as one of four key features of the Colorado River Storage Project Act (CRSPA) intended to develop the water resources of the Upper Colorado River Basin for the purposes of:

> . . .regulating the flow of the Colorado River, storing water for beneficial consumptive use, making it possible for the States of the Upper Basin to utilize, consistently with the provisions of the Colorado River Compact, the apportionments made to and among them in the Colorado River Compact

and the Upper Colorado River Basin Compact, respectively, providing for the Bureau of arid and semiarid lands, for the control of floods, and for the generation of hydroelectric power, as an incident to the foregoing purposes. . .

Other project purposes have been added as amendments to the 1956 CRSPA and include municipal and industrial use, recreation, and fish and wildlife.

After completion of Navajo Reservoir in December 1963, the focus for releasing water from the dam was primarily on meeting irrigation needs, providing flood control, maintaining stable flows, and providing a recreational pool in Navajo Reservoir. However, over the last decade, the focus and associated pattern for releasing water from Navajo Reservoir has changed. The effects that Navajo Reservoir Operations have had on the endangered Colorado pikeminnow and razorback sucker have resulted in various commitments by the Bureau to evaluate those effects and consider implementing release rules to benefit these endangered fish.

Formal consultation under the Act on Navajo Reservoir Operations was requested by the Bureau in a July 30, 1991, memorandum to the Service. The Bureau committed to operate Navajo Dam in a manner consistent with endangered fish recovery, including mimicking a natural hydrograph, for the life of the Navajo Dam. In an August 19, 1991, response to the Bureau, the Service concurred that the consultation process should be initiated, and that the consultation period for the project Navajo Reservoir Operations be extended while research on the San Juan River was conducted over a seven year period.

Alternatives

The San Juan River Basin Recovery Implementation Program (SJRBRIP) developed flow recommendations for the native fish community, including the endangered Colorado pikeminnow and razorback sucker, in the San Juan River of New Mexico, Colorado, and Utah. The SJRBRIP, which was initiated in 1992 had two goals:

(1) To conserve populations of Colorado pikeminnow and razorback sucker in the basin, consistent with the recovery goals established under the Endangered Species Act

(2) To proceed with water development in the basin in compliance with Federal and state laws, interstate compacts, Supreme Court decrees, and Federal trust responsibilities to the Southern Utes, Ute Mountain Utes, Jicarillas, and Navajos

To fully evaluate the endangered fish flow recommendations in SJRBRIP's "Flow Recommendations for the San Juan River" (Holden 1999) (Flow Report), the Bureau has developed three alternative flow release scenarios for Navajo Dam. The three alternatives are listed in table 1.

Table 1.—Operation alternatives used to analyze environmental impacts of implementing Flow Recommendations for the San Juan River

Alternatives	Range of flow releases from Navajo Dam
No Action Alternative	500 cfs minimum – 5,000 cfs maximum (14 to 142 cms)
250/5000 Alternative (Preferred Alternative)	250 cfs minimum – 5,000 cfs maximum (7 to 142 cms)
500/5000 Alternative	500 cfs minimum – 5,000 cfs maximum (14 to 142 cms)

Of the three listed alternatives, the Preferred Alternative is the only alternative that fully meets the flow recommendations.

Description of Alternatives

This section provides a description of each of the alternatives in terms of the maximum and minimum releases associated with proposed operating criteria to meet flow recommendations and provide a water supply for future development. Table 2 is a summary of how these alternatives meet certain categories and effect reservoir operation.

No Action Alternative.—Under this alternative, the Bureau would not meet the flow recommendations for endangered fish recovery. Navajo Dam and Reservoir would be operated as it was from 1973 through 1991, with minimum releases of about 500 cfs (14 cms) and maximum releases of about 5,000 cfs (142 cms). The operation criteria from 1973 - 1991 was to store as much water in the reservoir as possible and maintain constant flows downstream of the dam.

The No Action Alternative includes the depletion for Navajo Indian Irrigation Project (NIIP) blocks 1-8 (143,600 ac-ft) (17,713 ha-m). However, future water development (e.g., Animas La-Plata Project, Navajo Indian Irrigation Project blocks 9 - 11, Jicarilla Apache full settlement implementation, Navajo-Gallup Project, and unspecified minor depletions) would require consultation to avoid impacting federally listed species and other natural resources.

Navajo Reservoir inflow would average about 932,000 acre-feet per year (afy) (114,962 hectare-meters per year (hmy)). End-of-month water surface elevation would average about 6,063 ft (1,848 m) and range from a maximum of about 6,084 ft (1,854 m) to a minimum of about 6,016 ft (1,834 m) with a corresponding content of about 1,400,000 afy (172,689 hmy), 1,690,000 afy (208,461 hmy), and 882,000 afy (108,794 hmy), respectively.

Table 2.—Navajo Reservoir Operations EIS comparison of alternatives

Category	No Action Alternative	250/5000 Alternative (Preferred Alternative)	500/5000 Alternative
Maximum monthly release (cfs, cms)	5,000 (142)	5,000 (142)	5,000 (142)
Minimum monthly release (cfs, cms)	500 (14)	250 (7)	500 (14)
Average annual Navajo inflow (ac-ft, ha-m)	932,000 (114,962)	931,000 (114,838)	931,000 (114,838)
Average monthly Navajo EOM[1] content (ac-ft, ha-m)	1,400,000 (172,689)	1,330,000 (164,055)	1,260,000 (155,420)
Maximum monthly EOM content (ac-ft, ha-m)	1,690,000 (208,461)	1,700,000 (209,694)	1,680,000 (207,227)
Minimum monthly EOM content (ac-ft, ha-m)	882,000 (108,794)	634,000 (78,204)	560,000 (69,075)
Average Navajo Reservoir elevation (ft, m)	6,063.4 (1,848.1)	6,057.4 (1,846.3)	6,050.6 (1,844.2)
Maximum Navajo Reservoir elevation (ft, m)	6,084.4 (1,854.5)	6,085.0 (1,854.7)	6,083.9 (1,854.4)
Minimum Navajo Reservoir elevation (ft, m)	6,016.8 (1,833.9)	5,986.2 (1,824.6)	5,975.3 (1,821.3)
Meet Flow Recommendations	No	Yes	No
Average annual depletions (ac-ft, ha-m)	667,100 (82,286)	846,300 (104,391)	844,500 (104,169)
ALP	No	Yes	Yes
NIIP blocks 9-11	No	Yes	Yes
Minor unspecified	No	Yes	Yes
Jicarilla settlement	No	No	No
Ute settlement (over and above ALP depletions)	No	No	No
Navajo-Gallup Project	No	No	No

[1] End-of-month.

Average annual release to the San Juan River would be about 735,000 afy (90,662 hmy) with a maximum monthly flow of 5,000 cfs (142 cms) and a minimum monthly flow of 500 cfs (14 cms). Monthly releases would equal 500 cfs (14 cms) about 51 percent of the time and exceed 500 cfs (14 cms) about 49 percent of the time (Bureau, unpublished data). Monthly releases would exceed 1,000 cfs (28 cms) 32 percent of the time, 2,000 cfs (57 cms) 9.5 percent of the time and be equal to 5,000 cfs (142 cms) about 1 percent of the time.

San Juan River flows, below the confluence with the Animas River, would average about 1,300,000 afy (160,354 hmy) at Farmington, New Mexico, and about 1,400,000 afy (172,689 hmy) near Bluff, Utah. Maximum mean monthly flows would be about 4,400 cfs (124.6 cms) at Farmington and 4,300 cfs (122 cms) near Bluff, while minimum mean monthly flows would be about 800 cfs (23 cms) at Farmington and about 1,200 cfs (34 cms) near Bluff.

The Animas River at the confluence with the San Juan River would average about 570,700 afy (70,396 hmy). The maximum mean monthly flows would be about 2,700 cfs (76 cms) and more than 5,000 cfs (142 cms) in wet years. The minimum mean monthly flows would be about 240 cfs (7 cms), though in dry years the mean monthly flow could approach zero between Farmers Mutual Ditch and the confluence with the San Juan River (a distance of roughly 200 - 400 m).

The Bureau does not consider the No Action Alternative a viable alternative because it does not comply with the Act nor does it meet Indian Trust responsibilities; however, it is presented as a baseline to compare the other alternatives.

250/5000 Alternative (Preferred Alternative) (Flow Recommendations with 250 cfs [7 cms] Minimum Release and 5,000 cfs [142 cms] Maximum Release).— This alternative would implement the flow recommendations and Navajo Reservoir would be operated so that releases range from 250 cfs to 5,000 cfs (7 to 142 cms). Navajo Reservoir would provide a peak spring release of 5,000 cfs (142 cms) in most years and make releases to support base flows downstream of Farmington of 500 to 1,000 cfs (14 to 28 cms) for fish habitat and to conserve water for spring releases. This would require maintaining releases of 250 cfs (7 cms) during certain times of the year. Excess summer water would be released in brief peaks in the fall and winter.

The Preferred Alternative would include depletions of the No Action Alternative and assumes additional depletions; 57,100 afy (7,043 hmy) for the proposed Animas La Plata Project (ALP), 120,600 afy (14,876 hmy) for completion of the NIIP blocks 9-11, and 3,000 afy (370 hmy) for minor depletions defined in an intra-service consultation under the Act. These depletions are about 179,000 afy (22,080 hmy) greater than the No Action Alternative. Part of this difference includes a 1,600 afy (197 hmy) reduction in Navajo Reservoir evaporation due to Navajo Reservoir operating at lower water surface elevations because of increased demands. This alternative would meet the flow recommendations. Winter and summer low flow test releases have been conducted to assess how the 250 cfs (7 cms) minimum release would impact the trout fishery or water users located on that reach of river from Navajo Dam to the Animas River confluence.

Under this alternative, Navajo Reservoir inflow would average about 931,000 afy[1] (114,838 hmy). End-of-month water surface elevation would average about 6,057 ft (1,846 m) and range from a maximum of 6,085 ft (1,855 m) to a minimum of about 5,986 ft (1,825 m) with a corresponding content of about 1,330,000 ac-ft (164,055 ha-m), 1,700,000 ac-ft (209,694 ha-m), and 634,000 ac-ft (78,204 ha-m), respectively.

Average annual release to the San Juan River would be about 562,000 afy (69,075 hmy) with a maximum monthly flow of 5,000 cfs (142 cms) and minimum monthly flow of 250 cfs (7 cms). Monthly releases would equal 250 cfs (7 cms) about 28 percent of the time and exceed 250 cfs (7 cms) about 72 percent of the time (Bureau, unpublished data). Monthly releases would be between 250 to 500 cfs (7 to 14 cms) about 44 percent of the time, exceed 500 cfs (14 cms) about 28 percent of the time, 1,000 cfs (28 cms) about 15 percent of the time, and 2,000 cfs (57 cms) about 12 percent of the time. Monthly releases would equal 5,000 cfs (142 cms) about 1.5 percent of the time.

The Animas River at the confluence with the San Juan River would average about 476,500 afy (58,776 hmy). The maximum mean monthly flow would be about 2,500 cfs (71 cms) and the minimum mean monthly flow would be about 210 cfs (6 cms). In wet years, the monthly flow could be as high as 5,900 cfs (167 cms), while in dry years return flows from ALP would keep the river from totally drying up.

500/5000 Alternative. Flows of 500 cfs (14 cms) Minimum Release and 5,000 cfs (142 cms). —Maximum Release Under this alternative, Navajo Reservoir would be operated so that releases range from 500 to 5,000 cfs (14 to 142 cms). Navajo Reservoir would provide a peak spring release of 5,000 cfs (142 cms) and make releases to support base flows of 500 to 1,000 cfs (14 to 28 cms) downstream of Farmington for fish habitat and to conserve water for spring releases. Depletions would average about 844,500 afy (104,169 hmy), about 2,000 afy (247 hmy) less than the depletions under the Preferred Alternative. The differences are due to changes in Navajo Reservoir content resulting in about 1,400 afy (173 hmy) less evaporation, and shortages to water users of about 600 afy (74 hmy). This alternative would reduce potential low flow impacts to the downstream trout fishery and diversion structures by maintaining higher minimum releases. However, it would not meet all spring peak flow recommendations and shortages to NIIP would result. There would be times when the reservoir would be drawn down below the level of the NIIP inlet works and reservoir releases might have to be reduced to the minimum necessary to meet downstream senior water rights.

Navajo Reservoir inflow would average about 931,000 afy[1] (114,838 hmy). End-of-month water surface elevation would average about 6,051 ft (1,844 m) and range from a minimum of about 5,975 ft (1,821 m) to a maximum of about 6,084 ft (1,854 m) with a corresponding content of about 1,260,000 ac-ft (155,420 ha-m), 1,680,000 ac-ft (207,227 ha-m), and

[1] Inflows to Navajo Reservoir are 1,000 afy (123 hmy) less than under the No Action Alternative because 1,000 afy (123 hmy) of the 3,000 afy (370 hmy) of unspecified minor depletions are assumed to occur upstream of Navajo Dam.

560,000 ac-ft (69,075 ha-m), respectively. The minimum useable reservoir content is controlled by the elevation of the NIIP inlet works. Operating criteria requires the reservoir content to be no less than 661,800 ac-ft (81,633 ha-m) at elevation 5,990 ft (1,826 m) during the irrigation season and 625,675 ac-ft (77,177 ha-m) at elevation 5,985 ft (1,824 m) in winter. These minimums would be exceeded 18 out of the 780 months contained in the hydrology modeling study, resulting in water shortages.

Average annual release to the San Juan River would be about 565,000 afy (69,693 hmy) with a maximum monthly flow of 5,000 cfs (142 cms). Average monthly releases would be equal to 500 cfs (14 cms) about 78 percent of the time; greater than 500 cfs (14 cms) about 22 percent of the time; greater than 1,000 cfs (28 cms) about 10 percent of the time; greater than 2,000 cfs (57 cms) about 8 percent of the time; and equal to 5,000 cfs (142 cms) about 1.2 percent of the time (Bureau, unpublished data). Under this alternative, the reservoir would operate at a lower elevation than the other alternatives and during some years shortages to NIIP would result.

San Juan River flows below the confluence with the Animas River would average about 1,060,000 afy (130,751 hmy) at Farmington and about 1,210,000 afy (149,253 hmy) near Bluff. The maximum mean monthly flows would be about 4,100 cfs (116 cms) at Farmington and 4,100 cfs (116 cms) near Bluff, while minimum mean monthly flows would be about 700 cfs (20 cms) at Farmington and about 900 cfs (25 cms) near Bluff.

The Animas River at the confluence with the San Juan River would average about 488,000 afy (60,195 hmy). The maximum mean monthly flow would be about 2,500 cfs (71 cms) and the minimum average monthly flow would be about 210 cfs (6 cms). In wet years, the monthly flow could be as high as 5,600 cfs (159 cms), while in dry years return flows from ALP would keep the river from totally drying up.

Evaluation Methodology

Since 1991, the Service has attended meetings as a member of both the Biology and Coordination Committees to discuss project research and recovery actions. Several agencies including the Service's New Mexico Fishery Resources Office (NMFRO) conducted seasonal sampling of fish in the San Juan River project area from 1991 to the present. Sampling was conducted from the Animas River confluence in Farmington, New Mexico, to Clay Hills Crossing, Utah, near Lake Powell. Additional fish surveys were conducted in the tailwater trout fishery by the NMDGF and in the inflow area of Lake Powell by the Bureau.

Since the ability to manipulate flows in the river by reoperation of Navajo Dam is affected by other water use in the basin, a RiverWare operation model was developed to understand the impacts of and limitations on flow manipulation (Bliesner and Lamarra 1993). An Instream Flow Incremental Methodology (IFIM) study model (Bureau, unpublished data) was also prepared for this project to determine changes in habitat in the tailwater trout fishery immediately downstream of Navajo Dam. In addition, wetted perimeter, water surface elevation, and other empirical data were collected upstream of the Animas River confluence during the summer 2001 low flow test to assess changes in trout and native fish habitat. A Goede (1993) fish health assessment was also conducted to evaluate changes in trout health.

For any species' population to persist, a sufficient amount of suitable habitat for all life stages of a particular species must be available. To assess the influence of various flows on the fish community, particularly the native fish community downstream of the Animas River confluence, flow-habitat relationships for habitats used by fishes in the San Juan River were developed (Bliesner and Lamarra 1996). Habitats were mapped at flows between approximately 500 cfs (14 cms) and 10,000 cfs (283 cms). No flow-habitat data were mapped at flows less than 500 cfs (14 cms) downstream of the Animas River confluence until summer 2002. The 2002 flow-habitat data were not available for analysis in this report.

Fish and Wildlife Resources Without the Project

Under pre-SJRBRIP research management (1962-1991), discharges from Navajo Reservoir were relatively stable year-round from 1,200 to 1,400 cfs (34 to 40 cms). Regulated releases reduced spring flows and increased base flows. Since 1992 winter releases from Navajo Dam are typically about 500 cfs (14 cms). Non-winter releases are typically 500 to 5,000 cfs (14 to 142 cms). With implementation of the flow recommendations, winter, summer, and fall releases would decrease to as low as 250 cfs (7 cms). Spring releases from March through July would continue to be as high as 5,000 cfs (142 cms).

Most juvenile fish prefer shallow, low velocity habitats. For native fishes, in particular Colorado pikeminnow, these habitats include backwaters, shoals, eddies, pools, and slackwaters. In the San Juan River, these habitats comprise less than 15 percent of the total habitat (Bliesner and Lamarra 1996). Habitat modeling results show that area of backwater habitats downstream of the Animas River confluence are maximized at approximately 1,290,000 to 1,500,000 ft^2 (120,000 to 140,000 m^2) between 800 and 1,000 cfs (23 to 28 cms) (Holden 1999). Between 1,000 and 2,500 cfs (28 to 71 cms) there is a decline in area of backwater habitat. Backwater habitat is least abundant in area (approximately 269,000 to 592,000 ft^2 (25,000 to 55,000 m^2)) at flows near 2,500 cfs (71 cms). At flows between 2,500 and 4,000 cfs (71 to 113 cms) there is an increase in area of backwater habitats and at flows above 4,000 cfs (113 cms) there is little change in area. Shoal, pool, eddy, and slackwater habitats are generally more abundant than backwater habitats, though differ in area with changes in flow. Area of pool and shoal habitats decline from 500 to 1,500 cfs (14 to 42 cms). At flows above 1,500 cfs (42 cms) there is little change in area of pool and shoal habitats. Pool and shoal habitats generally increase with decreasing flows, though no habitat mapping was done at flows less than 500 cfs (14 cms). Area of slackwater habitat varies with flow, but generally increases from 500 to 1,000 cfs (14 to 28 cms) with little change above 1,000 cfs (28 cms). Eddy habitat increases in area as flows increase. Except for eddy and slackwater habitats, low velocity habitats generally decline with increasing flows.

Downstream of the Animas River confluence, low velocity habitat for juvenile fish is likely maximized (at roughly 17,200,000 ft^2 (1,600,000 m^2)) between 800 and 1,000 cfs (23 to 28 cms). However, at flows greater than 1,000 cfs (28 cms) there is still roughly 10,800,000 ft^2 (1,000,000 m^2) of low velocity shoal and slackwater habitats. In addition, at flows greater than 4,000 cfs (113 cms) there is nearly as much backwater area as there is at 800 to 1,000 cfs (23 to 28 cms) (Holden 1999).

For larger fish species, habitat preferences are more diverse but tend toward deeper, moderate velocity water compared to juveniles. In the San Juan River, runs typically comprise at least 70 percent of the total habitat, regardless of discharge (Bliesner and Lamarra 1996). Thus, there appears to be adequate adult fish (non-spawning) habitat available for both native (Miller and Ptacek 2000, Ryden 2000a) and non-native species (Holden 1999, Propst and Hobbes 1999).

For spawning, nearly all native fishes in the San Juan River require high spring flows to clean and prepare cobble bars for successful reproduction. Lack of suitable endangered species' spawning habitat may be a contributing factor to the poor condition of the San Juan River fishery. At present there is only one confirmed spawning site used by Colorado pikeminnow in the San Juan River. As more Colorado pikeminnow stocked as young-of-the-year (YOY) (Archer et al. 2000) reach sexual maturity additional spawning sites may be identified. Spawning habitat for razorback suckers may also be limited, though individuals stocked as juveniles appear to be locating spawning habitats adjacent to those used by native flannelmouth and bluehead suckers as they reach sexual maturity (Ryden 2000b).

Based upon IFIM modeling results and survey data in the trout habitat reach downstream of Navajo Dam, flows near 1,100 cfs (31 cms) appear to provide the most suitable habitat for adult rainbow trout (Kirk Lashmett, Bureau, pers. comm.). Between 500 and 250 cfs (14 to 7 cms) there is a reduction of total trout habitat in the Special Regulation water (approximately first 4 river mi (7 km) downstream of Navajo Dam) (Bureau 1998). There is a 30 percent reduction in trout habitat between Navajo Dam and Texas Hole (a distance of approximately 1.2 mi (1.9 km)). Between Texas Hole and the end of the Special Regulation water (approximately 2.8 mi (4.5 km)) there is a 37 percent reduction in total trout habitat. During the summer 2001 low flow test, flows between Citizens Ditch and the Animas River confluence ranged from 219 to 63 cfs (6 to 2 cms) (Bureau 2001). The lowest flows were immediately downstream of the Hammond Diversion structure. Future 250 cfs (7 cms) releases from Navajo Dam, with 100 percent withdrawal of diversion water rights, could reduce flows by an additional 50 cfs (1.4 cms) immediately below Citizens Ditch. Although irrigation return flows would ameliorate flow reductions by the time they reached the Animas River confluence, future flows between Citizens Ditch and the Animas River confluence would likely be less than those observed during the test.

Aquatic Resources

The aquatic resources in the San Juan River evolved in a system that is different than what exists today. Navajo Reservoir altered the temperature and flow regime of the river and has limited the upstream migration of native fishes. The downstream impoundment of Lake Powell has permanently inundated potentially important nursery habitats. The available fish habitat in the San Juan River from these two reservoirs has been reduced by about 80 mi (129 km) (Holden 2000). Encroachment of non-native terrestrial plant species, such as salt cedar and Russian olive, has armored and incised the river channel. Habitat loss and fragmentation from water development, including several (6 major) diversion structures, has contributed to changing the fishery downstream of Navajo Dam to Lake Powell. In addition, fish poisoning prior to the closure of Navajo Dam and the subsequent introduction of non-native fishes (both predators and competitors) has also permanently changed the fish community. Consequently, the existing aquatic communities in the project area differ from those that occurred historically (Platania 1990, Holden 1999).

Comprehensive studies of fish presence, abundance, distribution, or life history were not conducted on the San Juan River until the late 1980s (Holden 2000). Earlier studies were generally conducted to determine fish presence. The native ichthyofauna of the San Juan River is believed to have consisted of at least nine species, four of which are endemic to the Colorado River Basin (Tyus et al. 1982, Sublette et al. 1990, Platania 1990). Three of these are federally listed as endangered (bonytail chub, *Gila elegans*, Colorado pikeminnow, and razorback sucker) and one is State listed by New Mexico as threatened (roundtail chub, *Gila robusta*).

Bonytail chub remains have been collected in middens near Aztec, New Mexico, but are thought to have been extirpated from the San Juan River by the mid-1800s (Sublette et al. 1990). Razorback suckers were extirpated from the New Mexico portion of the San Juan River until they were reintroduced during the 7-year research period. Between 1991 and 1997 only 17 adult Colorado pikeminnow were collected between Shiprock, New Mexico, and Mexican Hat, Utah (Ryden 2000a). Historically, these latter two species are believed to have occurred in the basin (Animas River) upstream as far as Durango, Colorado, and downstream in the San Juan River to the confluence of the Colorado River. Roundtail chub, commonly found in previous surveys, were only occasionally collected during this same period. The reduction of native fish and the proliferation of non-native fish species in the San Juan River illustrates that the hydrologic and morphological changes in the channel have had an impact on aquatic resources. A list of common and scientific names of fish discussed in this report or that occur in the San Juan River project area is provided in Attachment A.

The San Juan River between Navajo Dam and Lake Powell supports a fish community consisting of 26 known species (and three hybrid sucker forms), including 7 native species (Ryden 2000a). Flannelmouth sucker are the most common large native species. Channel catfish are the most abundant large non-native species, particularly downstream of PNM weir, while red shiner are the most abundant small non-native. Other common native species include bluehead sucker and speckled dace. Other common non-native species include common carp, fathead minnow, and western mosquitofish. Game fish include rainbow trout, brown trout, channel catfish, striped bass, bluegill, largemouth bass, and walleye. Hence, the fishery in this section of river is varied and includes cold-water species in the upper reach, and a mix of warm- and cool-water species in the middle and lower reaches. The popular cold-water fishery is primarily dependent on stocking of rainbow trout by the NMDGF, natural reproduction by brown trout, and on cold water released from the bottom of Navajo Reservoir. Of the non-native species found in the river, at least three originate from Lake Powell. These include striped bass, walleye, and threadfin shad. Many more species probably originate from the drains and off-channel impoundments, particularly largemouth bass and sunfish. In summers with clear base flows, large numbers of striped bass move upstream from Lake Powell as far as the PNM weir (River Mile 166.1).

The most commonly collected non-native species, channel catfish, common carp, red shiner, and western mosquitofish, are tolerant of disturbed habitat. In the San Juan River, smaller species such as red shiner typically are most abundant in years with low spring peaks and lower, stable base flows (Propst and Hobbes 1999). Red shiners share common food resources (i.e., compete) with and prey upon larval native species including Colorado pikeminnow and native suckers (Propst and Hobbes 1999). Channel catfish both prey upon and use common food resources with native fishes (Brooks et al. 2000). Native suckers (up to 315 mm SL) have been collected in channel catfish stomachs in the San Juan River (Brooks et al. 2000). Channel catfish which have spiny pectoral spines have been documented to become lodged in the mouths of Colorado pikeminnow who try to prey upon them (Dale Ryden, Service, pers. comm.).

Though many of the same species were collected in New Mexico, Colorado, and Utah, there were longitudinal differences in species composition and abundance. Coldwater species (e.g., rainbow trout, brown trout, mottled sculpin) were more abundant in upstream reaches, and warmwater species (i.e., channel catfish, red shiners) were more abundant in downstream reaches, particularly downstream of PNM weir. Coolwater species (e.g., speckled dace, common carp) were generally abundant throughout most reaches. The highest proportion of native fishes (>90 percent) collected was between Hammond Diversion and the Animas River confluence (NMDGF 1994, unpublished data).

The NMDGF does not intensively manage the river downstream of the tailwater trout fishery (approximately15 mi (24 km) downstream of Navajo Dam) for any particular species, though there is a substantial channel catfish and a seasonal striped bass fishery downstream of PNM weir (Marc Wethington, NMDGF, pers. comm.). Protecting and enhancing the native fish community is also an objective of both the NMDGF and the Service.

Navajo Reservoir includes both a warm- and coldwater fish community representing 23 species and 9 families (Attachment B) (Alhm 1992, Marc Wethington, NMDGF, pers. comm.). Five of these species are native to the San Juan River Basin and 18 have been introduced from other river basins by various means. Native species are most often associated with the major tributary inflow areas such as the Pine, Piedra, and San Juan Rivers. Non-native kokanee salmon and rainbow trout populations are maintained through stocking by the NMDGF. Populations of the other species are maintained through natural reproduction and recruitment.

The primary fish species sought by anglers in Navajo Reservoir are smallmouth bass, largemouth bass, rainbow trout, brown trout, northern pike, and kokanee salmon. Other popular game fish species that are commonly caught include bluegill, black crappie, white crappie, green sunfish, and channel catfish.

Terrestrial Resources

Vegetation. —The project area lies within two physiographic regions including the Southern Rocky Mountains and the Colorado Plateau (Dick-Peddie 1993, Brown 1982). The vegetation types that dominate the project area are those characterized by Coniferous and Mixed Woodlands around Navajo Reservoir, and Great Basin Desert Scrub and Desert Grassland adjacent to the San Juan River downstream of Navajo Dam (Dick-Peddie 1993). Representative plants commonly occurring in the area downstream of Navajo Dam include: bluestems, Indian grass, switch grass, sideoats, Harvard shin oak, sand sagebrush, soap-weed yucca, mesquites, fourwing saltbush, rabbit brush, and snakeweed. Cacti include several hedgehogs, prickly-pears, and chollas. Riparian communities comprise the majority of the vegetation community along the San Juan River between the Navajo Dam and Lake Powell. Riparian vegetation includes Fremont cottonwood, coyote willow, Russian olive, salt cedar, Siberian elm, black locust, and honey locust. A list of common and scientific names of vegetation discussed in this report is provided in Attachment C.

Much of the project area has been disturbed by cattle and sheep grazing, urban development, oil and gas drilling, and surface mining. The cumulative habitat alterations, combined with large-scale water development, have altered much of the native wetland and riparian communities along the San Juan River. Although native willows and cottonwoods still exist, more than 85 percent of the vegetation community along the floodplain of the San Juan River has been replaced by non-native Russian olive and salt cedar.

Prior to large scale water development projects, the San Juan River floodplain was comprised of trees, shrubs, and grassland dependent upon periodic flooding. A major historical component of native vegetation along the San Juan River was cottonwood woodland. This deciduous woodland is best developed along alluvial floodplains of large, low-gradient, perennial streams that flow through wide, unconstrained valleys. The vegetation is dependent on a subsurface water supply and varies considerably with the height of the water table. Major flood events and consequent flood scour, overbank deposition of water and sediments, and stream meandering are important factors that shape this community (USGS 1998).

Navajo Reservoir is located in Coniferous and Mixed Woodlands (Dick-Peddie 1993). Common vegetation species include pinon pine, junipers, and big sage (City of Farmington 1983). The predominant vegetation community along the shoreline in the reservoir is riparian vegetation. Representative species include cottonwood, willow, and a variety of shrubs. Much of the riparian, wetland, and other important habitats surrounding the reservoir are impacted by heavy recreational use, natural gas development and associated activities, and grazing (Bureau 1999).

Mammals. —Commonly observed mammals along the San Juan River corridor include the coyote, red fox, ground squirrel, raccoon, and porcupine (Findley et al. 1975). Other mammals include the beaver, muskrat, desert cottontail, jackrabbit, and kangaroo rat. Desert bighorn sheep are often observed, and to a lesser extent mule deer, in the canyon areas near Mexican Hat, Utah. Mule deer are commonly observed between Navajo Dam and the Animas River confluence. Reaches upstream of the Animas River confluence and downstream of Bluff, Utah, because they are more remote areas, likely have a larger diversity and higher abundance of native mammals. A list of common and scientific names of mammals discussed in this report is provided in Attachment D.

Birds. —The San Juan Valley attracts large numbers of waterfowl. The diversity of avian species that seasonally frequent the San Juan Valley is high because of the variable habitats associated with the San Juan River floodplain; and the location of the reservoirs within a migratory corridor along the San Juan River. Schmitt (1973) documented 136 species of birds between Hogback, New Mexico, and Navajo Dam. Many of these species are associated with riparian-wetland habitats and include waterfowl, raptors, and neotropical migrant songbirds. Birds commonly located in the vicinity of the project area associated with riparian habitat include the mourning dove, Gambel's quail, common raven, and red-tailed hawk (Schmitt 1973). A list of common and scientific names of birds discussed in this report is provided in Attachment E.

Hink and Ohmart (1984), found that riparian areas are used heavily by most bird species in New Mexico. Cottonwood-dominated community types are used by large numbers of bird species, and are preferred habitat for a large proportion of the species, especially during breeding season. Bird density appears to be strongly related to density of foliage, regardless of species composition of the plant community. Marshes, drains, and areas of open water contribute to the diversity of the riparian ecosystem as a whole because of their strong attraction for water-loving birds. At various times of the year, these areas support the highest bird densities and species numbers in the San Juan Basin (Schmitt 1973).

Amphibians and Reptiles. —There are 26 known amphibian and reptile species in the New Mexico portion of the project area (Degenhardt et al. 1996). These include 11 lizard species, 7 snake species, 6 toad (or frog) species, 1 salamander species, and 1 turtle species. Commonly occurring reptiles in the project area include the collared and short-horned lizards, bullsnake, western rattlesnake, and the black-neck garter snake. In the river corridor, commonly occurring amphibians include the New Mexican spadefoot and Woodhouse's toad. A list of common and scientific names of amphibians and reptiles discussed in this report is provided in Attachment F.

Most amphibians depend on the aquatic habitat of riparian areas for at least a portion of their life cycle. Amphibians associated with wetter riparian areas with wet meadows and marshes are chorus frogs, leopard frogs, and bullfrogs (Crawford et al. 1993). Their presence in the project area varies locally depending upon availability of wet meadows and marshes.

Threatened and Endangered Species

As the quality and quantity of the fish and wildlife habitat within the San Juan River has decreased over time from habitat alteration and large-scale water development, so has its ability to sustain native flora and fauna. Several species native to the valley have been listed on the Federal threatened and endangered species list under the Act. Listed species that could be present are; Colorado pikeminnow, razorback sucker, southwestern willow flycatcher and bald eagle.

Colorado Pikeminnow. —The project is also within the known and historic range of the Colorado pikeminnow. The pikeminnow was listed by the Service as endangered March 11, 1967 (32 FR 4001). The current range of the pikeminnow includes Colorado, New Mexico, Utah, and Wyoming. Critical habitat for the pikeminnow was designated March 21, 1994 (59 FR 13374). Critical habitat for Colorado pikeminnow begins at the State Highway 371 bridge (T 29 N, R 13 W, Sec. 17) in Farmington, New Mexico, and includes the 100-year floodplain downstream to the mouth of Neskahai Canyon (T 41 S, R 11 E, Sec. 16), Utah, on the San Juan arm of Lake Powell. Critical habitat includes areas of the floodplain that when flooded would provide fish habitat. The primary constituent elements for critical habitat include, but are not limited to, the river channel, bottomlands, side channels, secondary channels, oxbows, backwaters, and other areas in the 100-year floodplain, which when inundated, provide spawning, nursery, feeding or rearing habitat. Areas within the 100-year floodplain that do not provide the primary constituent elements do not meet the definition of critical habitat. For example, a parking lot within the 100-year floodplain would not be considered critical habitat.

Razorback Sucker. —The project is also within the known and historic range of the razorback sucker. The razorback sucker was federally listed by the Service as endangered October 23, 1991 (56 FR 54947). The current range of the razorback sucker includes Arizona, California, Colorado, New Mexico, Nevada, Utah, Wyoming, and Mexico. Critical habitat for the razorback sucker was designated March 21, 1994 (59 FR 13374). Critical habitat for razorback sucker begins at the Hogback Diversion (T 29 N, R 16 E, Sec. 9) and includes the 100-year floodplain downstream to the mouth of Neskahai Canyon, Utah, on the San Juan arm of Lake Powell. The primary constituent elements for critical habitat are similar to those for Colorado pikeminnow and fall into three general areas: water, physical habitat, and the biological environment (Maddux et al. 1993).

Southwestern Willow Flycatcher. —The Service federally listed the southwestern willow flycatcher (flycatcher) as endangered on February 27, 1995 (Service 1995b). The flycatcher is also classified as endangered or a species of concern by the States of Arizona, California, New Mexico, and Utah. Critical habitat for the flycatcher was designated July 22, 1997; and was subsequently challenged in the 10th Circuit Court of Appeals, leading to a decision that set aside the critical habitat designation on May 11, 2001 (*New Mexico Cattle Growers Association et al.* v. *United States Fish and Wildlife Service, No. CIV-98-275-LH*). The current range of the flycatcher includes southern California, southern portions of Nevada and Utah, Arizona, New Mexico, western Texas, and southwestern Colorado (Unitt 1987, Browning 1993). In New Mexico, the species has been observed in the San Juan, Rio Grande, Rio Chama, Zuni, San Francisco, and Gila River drainages. Available habitat and overall numbers have declined statewide (Service 1997).

Loss and modification of nesting habitat is the primary threat to this species (Phillips et al. 1964, Unitt 1987, Service 1993). Loss of habitat used during migration also threatens the flycatcher's survival. Large scale losses of southwestern wetlands have occurred, particularly the cottonwood-willow riparian habitats used by the flycatcher (Phillips et al. 1964, Carothers 1977, Rea 1983, Johnson and Haight 1984, Howe and Knopf 1991).

The flycatcher is a riparian obligate and nests in riparian thickets associated with streams and other wetlands where dense growth of willow, buttonbush, boxelder, Russian olive, salt cedar, or other plants are present. Nests are often associated with an overstory of scattered cottonwood. Throughout the flycatcher's range, these riparian habitats are now rare, widely separated by vast expanses of arid lands. Flycatchers nest in thickets of trees and shrubs approximately 6.6 to 22.9 ft (2 to 7 m) in height or taller, with a densely vegetated understory from ground or water surface level to 13.1 ft (4 m) or more in height. Surface water or saturated soil is usually present beneath or next to occupied thickets (Phillips et al. 1964, Muiznieks et al. 1994). At some nest sites, surface water may be present early in the breeding season with only damp soil present by late June or early July (Muiznieks et al. 1994, Sferra et al. 1995). Habitats not selected for either nesting or singing are narrower riparian zones, with greater distances between willow patches and individual willow plants. Suitable habitat adjacent to high gradient streams does not appear to be used for nesting. Areas not selected for nesting or singing may still be used during migration.

Flycatchers begin arriving in New Mexico in late April and May. Breeding begins in late spring, and young begin to fledge in early summer. Late nests and re-nests may not fledge young until late summer (Sogge and Tibbitts 1992, Sogge et al. 1993).

Occupied and potential flycatcher nesting habitat exists along the San Juan River. Although no territories were identified along the San Juan River in 2001, three territories were documented as recently as 1998. Occupied and potential habitat is primarily composed of riparian shrubs and trees, chiefly Goodding's willow and peachleaf willow, Fremont cottonwood, coyote willow, and salt cedar. The habitat within the project area does provide nesting habitat for the flycatcher, and some flycatchers may use the area during migration. Habitat in nesting areas has mature cottonwoods, often bordered or mixed with salt cedar and Russian olive, with small patches of willows along the high flow channels.

Bald Eagle.—The project is also within the known and historic range of the bald eagle. The Service reclassified the bald eagle from endangered to threatened on July 12, 1995 (Service 1995c). The Service proposed removing the bald eagle from the list of endangered and threatened wildlife on July 6, 1999 (Service 1999). That proposal has yet to be finalized.

Wintering bald eagles frequent all major river systems in New Mexico from November through March, including the San Juan River. The favored prey of bald eagles is fish, waterfowl, and small mammals. Bald eagles prefer to roost and perch in large trees near water. There are many potential perch sites in the project vicinity where large cottonwoods occur at the river's edge.

Future Conditions Without the Project

The No Action Alternative for this project is the affected environment with trends through the life of the Project. Baseline biological conditions were projected through time to develop expected trends and future conditions.

Pre-research trends in the project area include a decline in endangered Colorado pikeminnow and razorback sucker populations and their habitat. This decline would be expected to continue. In addition, non-native populations of channel catfish, common carp, and red shiners would continue to persist and negatively interact with the native fish community. Rural and urban development would be concentrated between Navajo Reservoir, New Mexico, and Mexican Hat, Utah. Demand for water and water development would continue to increase. Expected future trends for aquatic and terrestrial resources include the following:

- ❑ Relatively stable, constant releases from Navajo Dam would continue to decrease endangered fish species habitat.
- ❑ Relatively stable, constant releases from Navajo Dam would continue to promote encroachment of non-native vegetation in riparian habitats.
- ❑ Seasonal reservoir level fluctuations would continue to limit spawning success and recruitment of many reservoir fishes.
- ❑ Seasonal reservoir level fluctuations would continue to limit the forage and prey base (e.g., crayfish) for many reservoir fishes.
- ❑ Lower peak releases (< 5,000 cfs (142 cms)) from Navajo Dam during spring runoff would not clean gravels necessary for spawning and recruitment by self-sustaining brown trout populations.
- ❑ Relatively stable, year-round releases from Navajo Dam near 1,000 cfs (28 cms) would maximize suitable (non-spawning) adult trout habitat and sustain high macro-invertebrate densities in the Special Regulation water.

Because reoperation of Navajo Dam would not occur with implementation of the No Action Alternative, there would be few or no associated short-term or long-term aquatic and terrestrial resource changes. However, endangered fish species and their habitat would continue to decline, leading to extirpation from the San Juan River.

For Navajo Reservoir, the predicted trend would be for average water levels to be highest (i.e., 6,063.4 ft (1,848 m)) under the No Action Alternative. Annual reservoir water level elevations would range from 6,016.8 ft (1,834 m) to 6,084.4 ft (1,854 m). Similar to historic (1973 to 1991) reservoir conditions, patterns of reservoir water level change within a year would be highest during spring (April through June). Water level changes such as these, together with a consistent pattern of water level fluctuation over the life of the project, would be expected to have little or no adverse effects on shoreline vegetation communities at Navajo Reservoir.

There are currently no detailed area and capacity tables to determine availability of potential reservoir spawning habitat in Navajo Reservoir. The amount of suitable spawning habitat (defined by water less than 4 ft (1.2 m) deep) is not known. However, a study by the NMDGF in Navajo Reservoir showed an increase in young smallmouth bass abundance between 1988 and 1991 (Alhm 1992). This was presumably because high, stable reservoir levels provided better conditions for spawning and recruitment than previously existed. Conditions for the smallmouth bass prey base (i.e., crayfish) may also have been better. Thus, seasonal reservoir changes expected with the No Action Alternative would likely result in natural reproduction and recruitment of reservoir fishes similar to historic (1973 to 1991) conditions.

Although there would be no expected changes to vegetation around Navajo Reservoir associated with the No Action Alternative, continued encroachment by non-native Russian olive and salt cedar would negatively impact native plants and other terrestrial communities downstream of Navajo Dam. No changes to mammal populations would be expected with the No Action Alternative.

Threatened and Endangered Species. —Issues with federally listed species will be addressed in detail during section 7 consultation under the Act. The Service is presenting this information to assist in the evaluation of the alternatives. Under the No Action Alternative, suitable native flycatcher habitat would likely decline in the Project area because of continued encroachment by non-native Russian olive and salt cedar, and an associated loss of willows. Without adequate cottonwood regeneration, bald eagle perch habitat would continue to decline. There would, however, be no expected changes to the forage base of wintering bald eagles. Colorado pikeminnow and razorback sucker populations and their habitat would continue to decline. Roundtail chub, a species listed by the State of New Mexico as threatened, would also likely continue to decline.

Fish and Wildlife Resources with the Project

250/5000 Alternative (Preferred Alternative)

Impacts from the operation of Navajo Dam are discussed below. For planning purposes, it is assumed that the operation of the dam would occur in the following manner:

During the life of the project, minimum releases would be 250 cfs (7 cms) and peak spring releases (March through July) would be 5,000 cfs (142 cms).

The impacts associated with the project features for the Preferred Alternative are:

- Restoration of natural processes associated with mimicry of a natural hydrograph (i.e, recruitment of native riparian vegetation, establishment and maintenance of native fish and endangered species habitats) downstream of the Animas River confluence.

- Loss of 30 to 37 percent of trout habitat in the Special Regulation water (i.e., first 4 river mi (7 km) below Navajo Dam) when flows are reduced from 500 to 250 cfs (14 to 7 cms).

- Variable loss of riverine habitat in 44 mi (71 km) of the San Juan River between the Special Regulation water and the Animas River confluence for both the native fish community and the trout fishery when flows are reduced from 500 to 250 cfs (14 to 7 cms), particularly in summer.

- Less primary and secondary productivity upstream of the Animas River confluence because of less wetted surface area (in summer, fall, and winter) and wider range of annual flow fluctuations.

- Lower base flows upstream of Animas River confluence to Hammond Diversion could provide a competitive advantage to non-native fishes over the native fish (primarily sucker) community.

- Degraded water quality upstream of the Animas River confluence during lower base flow releases (e.g., higher proportion of contaminants from irrigation return water, potentially higher lethal water temperatures and lower dissolved oxygen from sustained lower base flows).

Implementation of the Preferred Alternative includes additional depletions in the San Juan River basin. As future water projects are planned and developed, temporary, short-term impacts to fish and wildlife resources may occur during construction from noise, dust, and the presence of workers and machinery during project construction. Placement and removal of temporary cofferdams, construction forms, and backfill could increase turbidity. Runoff from construction work sites, access routes, staging areas, and unprotected fills could degrade water quality in the river. Uncured concrete could increase alkalinity and conductivity, water quality factors to which cool water biota are sensitive. Accidental spills of fuels, lubricants, hydraulic fluids and other petrochemicals, although unlikely, would be harmful to aquatic life. Changes in flow through de-watering of the construction site could cause direct mortality to fish and aquatic invertebrates, and could disrupt fish spawning and cause mortality of incubating eggs downstream of construction sites.

Expected future trends for aquatic and terrestrial resources include the following:

- ❑ Average depletions from Navajo Reservoir are expected to increase by about 177,000 ac-ft (21,833 ha-m).

- ❑ Frequency of peak 5,000 cfs (142 cms) daily releases from Navajo Dam in the spring season (March through July) are expected to increase by more than three-fold above the No Action Alternative.

- ❑ Lower summer, winter, and fall releases from Navajo Dam would decrease wetted streambed area, reduce primary and secondary productivity, and reduce carrying capacity, particularly in reaches upstream of the Animas River confluence.

To meet the (water development and spring release) demands associated with the Preferred Alternative, water would need to be released from Navajo Dam to mimic a pre-dam hydrograph. One benefit of the Preferred Alternative for the San Juan River fishery and other aquatic-dependent species lies in its contribution to a more natural year-round flow regime. A more natural flow regime would be necessary to enhance the riverine ecosystem, particularly the native aquatic and riparian communities. The frequency of 5,000 cfs (142 cms) peak releases from Navajo Dam during spring runoff with the Preferred Alternative would increase from about 16 to 69 percent. Minimum releases during summer, fall, and winter (July through February) would be about 50 percent lower (250 cfs versus 500 cfs, 7 versus 14 cms) than the No Action Alternative. Average monthly releases during summer and fall (July through October) would be about 57 percent lower (430 cfs versus 1,000 cfs, 12 cms versus 28 cms) than the No Action Alternative, and during winter about 51 percent lower (390 cfs versus 790 cfs, 11 versus 22 cms).

In most years, peak spring releases from Navajo Dam would increase compared to the No Action Alternative with a target release of 5,000 cfs (142 cms). This increase in flow would continue approximately 44 river mi (71 km) downstream to the Animas River. Flows would then continue to increase, or stabilize, to Lake Powell as a result of tributary inflows.

Winter base flow decreases in more than 44 mi (71 km) of river would provide little or no benefit to the native fish community and trout fishery. While lower winter base flows would not likely produce acute effects, these fisheries would be limited by reduced habitat availability, reduced primary and secondary productivity, and possible competition from non-native fishes. Decreased winter flows could reduce the carrying capacity for fisheries upstream of the Animas River confluence.

Lower base flow releases in more than 44 mi (71 km) of river during summer and fall releases would be compounded by additional depletions from irrigation diversions. Results of the July 2001 summer low flow test showed an increase in water temperatures and a decrease in dissolved oxygen and wetted perimeter, particularly between Citizens Ditch and the Animas River confluence. Other water quality parameters did not show any acute reductions, though long-term, cumulative impacts could not be assessed from the short-term test. The effect of prolonged reduced flows could prompt fish, particularly native suckers, to move upstream or downstream to seek more suitable habitats. Brown and rainbow trout below Citizens Ditch might also move upstream to seek more suitable habitats.

The lower winter, summer, and fall base flow releases with the Preferred Alternative would decrease the wetted streambed perimeter. Aquatic productivity is generally related to the amount of streambed area that is wetted. Shallow areas, especially riffles, are the primary production areas for aquatic invertebrates, which constitute much of the food base for fish and many shorebirds. Some losses in wetted perimeter would be realized with reductions in dam releases from 500 cfs (14 cms) to 250 cfs (7 cms). These reductions would be most pronounced upstream of the Animas River confluence where average winter releases would decrease by about 50 percent and summer and fall releases would decrease by about 57 percent. In addition, irrigation depletions and changing releases from Navajo Dam to meet downstream endangered species needs in summer and fall would result in frequent flow fluctuations. These fluctuations would further reduce or limit aquatic productivity. Lower base flows and frequent fluctuations in summer and fall releases would reduce the forage base and the carrying capacity of fisheries upstream of the Animas River confluence. Downstream of the Animas River confluence to Lake Powell, the Preferred Alternative would provide minimum base flows of 500 cfs (14 cms) through critical habitat for endangered species.

Decreased winter base flows would increase shallow water habitat, particularly in areas upstream of the Animas River confluence. These habitats are important to shorebirds (e.g., killdeer, least sandpiper), wintering migratory birds, hibernating amphibians and reptiles, and juvenile fish species. Although lower flows would provide more shallow water habitats, they could also reduce the forage or prey base for many of these same species.

During the spring season, reservoir releases would increase to 5,000 cfs (142 cms) with the Preferred Alternative, primarily to meet endangered fish species spawning and young-of-the-year habitat needs. Flows downstream of the Animas River confluence, for example, would periodically increase to 10,000 cfs (2,830 cms), or greater.

The duration and timing of high flows typical of the spring season (greater than 10,000 cfs; 2,830 cms) provide better spawning habitat for the fish community and provide better conditions for the (native) riparian-wetland plant community. The flow decreases in the San Juan River upstream of the Animas River confluence during summer, fall, and winter seasons with the Preferred Alternative would have varying effects on the fish community. Although the effects of reduced flows on the hydrology supporting the riparian-wetland plant community was minimal during low flow tests, long term impacts to these habitats are not known.

The predicted average end-of-month water surface elevation of Navajo Reservoir with the Preferred Alternative would be 6,057.4 ft (1,846 m); 6 ft (1.8 m) lower than the No Action Alternative. The range in reservoir surface elevations would be greater under the Preferred Alternative, with a minimum elevation of 5,986.2 ft (1,825 m) and a maximum elevation of

6,085.0 ft (1,855 m). Though the range in reservoir surface elevations is broader under the Preferred Alternative, predicted reservoir surface elevations in May would be more stable (i.e., level to slowly rising) roughly 60 percent of the time. Depending upon availability of spawning habitat, this would provide better spawning conditions for both crappie and smallmouth bass in most years. In June, changes in reservoir water elevations would be similar to the No Action Alternative approximately 50 percent of the time, and greater (i.e., declining) the other 50 percent of the time. This would provide less suitable spawning conditions for largemouth bass about half the time, compared to the No Action Alternative. In October through April, predicted changes in reservoir surface elevations would typically be less than the No Action Alternative. This would reduce mortality to crayfish which become stranded by declining reservoir levels in fall and winter, thereby providing a better forage base, particularly for smallmouth bass. Overall, the Preferred Alternative would likely provide better conditions for natural reproduction and recruitment of smallmouth bass and crappie, and less suitable conditions for spawning largemouth bass. In addition, the Preferred Alternative would likely provide better conditions for crayfish, an important prey item for smallmouth bass.

500/5000 Alternative

Future trends to aquatic and terrestrial resources with the 500/5000 Alternative are similar to the Preferred Alternative. The Preferred Alternative and the 500/5000 Alternative are similar in terms of spring flows, and associated project impacts. However, compared to the Preferred Alternative, the 500/5000 Alternative would not adversely effect the native fish community, the trout fishery, or the wetland-riparian plant community upstream of the Animas River because of higher base flows (i.e., 500 versus 250 cfs (14 versus 7 cms). In Navajo Reservoir, the 500/5000 Alternative has more associated (negative) impacts to aquatic resources than the Preferred Alternative because of higher reservoir fluctuations and lower reservoir levels.

Threatened and Endangered Species

These project issues will be addressed during section 7 consultation under the Act.

Discussion

The Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-667e) directs the action agency to consult with the Service for purposes of "preventing a net loss of and damage to wildlife resources." It further directs the Federal action agency to give wildlife conservation measures equal consideration to features of water resource development. Consideration is to be given to all wildlife, not simply those that are legally protected under the Act or those with high economic and recreational value. Further, the recommendations of the Service which follow are to be given full consideration by the action agency. All aspects of the Project should be analyzed and designed to avoid and minimize impacts to wildlife resources.

Projects that result in adverse impacts to fish and wildlife require the development of mitigation plans. These plans consider the value of fish and wildlife habitat affected. The Service has established a mitigation policy used as guidance in recommending mitigation (Service 1981). The policy states that the degree of mitigation should correspond to the value and scarcity of the fish and wildlife habitat at risk. Four resource categories in decreasing order of importance are identified:

Resource Category No. 1 – Habitats of high value for the species being evaluated that are unique and irreplaceable on a national basis or in the ecoregion section. No loss of existing habitat value should occur.

Resource Category No. 2 – Habitats of high value that are relatively scarce or becoming scarce on a national basis or in the ecoregion section. No net loss of in-kind habitat value should occur.

Resource Category No. 3 – Habitats of high to medium value that are relatively abundant on a national basis. No net loss of habitat value should occur and loss of in-kind habitat should be minimized.

Resource Category No. 4 – Habitats of medium to low value. Loss of habitat value should be minimized.

The habitats in the immediate project area are classified as follows: Resource Category No. 2 – riparian vegetation (includes trees and shrubs such as willows) and aquatic habitat.

Riparian habitats are classified in category 2 because they are scarce and are rapidly disappearing. About 90 percent of the historic wetland and riparian habitat in the southwest has been eliminated (Johnson and Jones 1977). The mitigation goal for riparian areas (trees and shrubs) in the project area is no net loss in wildlife value as a result of the proposed project.

Aquatic habitats are classified in category 2 because they are relatively scarce in the Southwest and provide high wildlife value for several native fish species (e.g., Colorado pikeminnow, razorback sucker, flannelmouth sucker). The aquatic habitat in the project area also supports a world class trout fishery. The mitigation goal for aquatic habitat (e.g., backwaters, riffles, and runs) in the project area is to have no net loss of habitat value as a result of the proposed project.

Once mitigation measures have been implemented, monitoring programs must be established to evaluate their effectiveness. Where monitoring reveals that mitigation is ineffective or deficient, measures must be adjusted so that full compensation is attained.

Mitigation of impacts should not be considered complete until those measures have been evaluated to ensure full compensation of resources impacted by the Project. Mitigation must be implemented concurrent with, or in advance of, impacts to the resources.

The Service has ranked the Project alternatives in terms of their potential impacts on aquatic and terrestrial resources from least to most:

- 500/5000 Alternative
- 250/5000 Alternative (Preferred Alternative)
- No Action Alternative

In addition to ranking the alternatives, the Service has rated the alternatives in terms of their potential to enhance aquatic and terrestrial communities. The 250/5000 Alternative (Preferred Alternative) and the 500/5000 Alternative have the most beneficial long-term potential based upon the expected flow regime. However, the 500/5000 Alternative does not meet all spring peak flow recommendations; and would result in occasional water shortages to users (less than one percent of the time). The Preferred Alternative meets the flow recommendations, but these recommendations will adversely effect portions of the native fish community and the trout fishery upstream of the Animas River, particularly in summer and fall. The Preferred Alternative and the 500/5000 Alternative are similar in terms of spring flows, and associated project impacts. Upstream of the Animas River confluence, the Preferred Alternative has more associated (negative) impacts to aquatic resources in the San Juan River due to lower base flow releases and more fluctuations in summer and fall.

Impacts from implementation of the Preferred Alternative include variable losses in aquatic habitat and water quality upstream of the Animas River confluence. During low flow (250 cfs, 7 cms) releases in summer and early fall, fish may need to move from previously suitable habitats to areas with better water quality. Diversion structures such as the Hammond Diversion would be impediments or barriers to fish seeking habitats in other areas. Impacts from implementation of the 500/5000 Alternative are primarily to the reservoir fishery because of higher reservoir fluctuations and lower average reservoir levels.

The mitigation proposals incorporate many of the recommendations described in the PDEIS (Bureau 2001). Mitigation provides an opportunity to restore fisheries habitat upstream of the Animas River confluence, and enhance native riparian communities.

Removing non-native vegetation would more readily allow peak spring flow to "spill"onto the floodplain to water areas. Providing more frequent off-channel inundation would create additional riverine habitat and promote native riparian habitat development.

Implementation of the Preferred Alternative (identifies and) assumes additional depletions in the San Juan River basin. As future water projects are developed by the Bureau, to minimize temporary, short-term impacts during construction of projects and associated features, the following measures should be implemented:

- ❑ Construction activities in the San Juan River should be conducted during low flow or low precipitation periods.

- ❑ Construction work areas should be de-watered with cofferdams constructed of materials that cannot be brought into suspension by flowing water.

- ❑ Runoff from construction sites should be contained and poured concrete should be contained in sealed forms and/or behind cofferdams to prevent discharge into the river.

- ❑ Place no surplus concrete within the 100-year floodplain. Contain and treat or remove wastewater from concrete batching, vehicle washdown, and aggregate processing.

- ❑ Place only clean, coarse, and erosion-resistant fills in the water and employ silt curtains, settling basins, or other suitable means to control turbidity.

- ❑ Store and dispense all fuels, lubricants, hydraulic fluids, and other petrochemicals above the 100-year floodplain.

- ❑ Inspect all equipment daily to ensure there are no leaks or discharges of lubricants, hydraulic fluids, or fuels.

- ❑ Contain and remove any petrochemical spills, including contaminated soil, and dispose of these materials at an approved upland disposal site.

- ❑ All temporarily disturbed construction areas should be revegetated with native vegetation following construction activities.

The time periods for future construction of water development projects may overlap with bald eagle winter habitat use in potential project areas. Since bald eagles are sensitive to human disturbance, construction activities within project areas may cause them to move and concentrate at other sites or use less than optimal habitat. Impacts can be minimized by delaying the beginning of construction activities in the morning if a bald eagle is present in or near the construction area.

If an eagle is present within 0.5 mi (0.8 km) upstream or downstream of an active project site in the morning before project activity starts, or following breaks in project activity, the contractor should be required to suspend all activity until the bird leaves of its own volition, or in consultation with the Service, determines that the potential for harassment is minimal. However, if an eagle arrives during construction activities or if an eagle is beyond that distance, construction need not be interrupted. If bald eagles are found consistently in the immediate area of a project during the construction period, the contractor should contact the Service to determine whether formal consultation under the Act is necessary.

One benefit of the two proposed actions for the San Juan River fisheries and other aquatic-dependent species is the contribution to a more natural year-round flow regime. The research and flow habitat analysis identifies seasonal changes in fish habitat that should help focus the mitigation measures consistent with the recovery goal (Preferred Alternative) to conserve the San Juan River fish community to the extent practicable.

In summarizing the fisheries analysis (e.g., fish health assessment) and habitat modeling of stream flows for both the No Action and the Proposed Alternatives, it is evident that changes in flow effect availability of aquatic habitats and potentially fish health. Because of actual and potential losses of aquatic habitats upstream of the Animas River confluence, particularly during low summer and fall releases, the Service recommends the following general measures to mitigate these impacts. Create or deepen existing pool habitats; stock trout in fall where sustained lower flows impact populations; monitor and implement measures to avoid impacting flannelmouth and bluehead sucker populations in the San Juan River and reservoir fish species populations; monitor and implement measures to avoid impacting water quality (e.g., water temperature, dissolved water quality); and monitor flow-related changes to wetland-riparian communities.

Development of wetland habitat could be increased by lowering river banks in areas identified as appropriate, thus improving conditions for a variety of fish and wildlife. In addition, portions of the riparian area could be restored by removing non-native vegetation and planting native vegetation, improving wildlife habitat conditions, especially for birds.

Recommendations

Based upon the evaluation of fish and wildlife impacts of the proposed action, and the existing ecosystem condition of the San Juan River from Navajo Reservoir to Lake Powell, the following recommendations are provided by the Service. These recommendations are for the Preferred Alternative.

To mitigate for expected impacts of the proposed action:

(1) Create pool habitat or deepen existing pools (or other habitats) in areas affected by lower (< 500 cfs; 14 cms) dam releases, particularly in the Special Regulation water.

(2) Establish in-stream structures (e.g., log deflectors, boulder placement, rock weirs), where feasible, from Simon Canyon to the takeout of the Special Regulation water and downstream of Citizens Ditch to scour pools and/or provide cover during low flows.

(3) Develop fish passage at existing diversion structures in both the lower Animas and upper San Juan Rivers (e.g., Hammond Diversion).

(4) Stock both juvenile and adult trout downstream of Citizens Ditch (in fall or early winter) where sustained lower summer flows could impact wild trout populations.

(5) Develop gravel traps to retain (or replace, if necessary) cobbles and gravels displaced during high spring flows upstream of Simon Canyon (i.e., area downstream of dam without tributary input of gravels). By locating gravel traps in areas that will not be dewatered, this would also mitigate for loss of aquatic invertebrates desiccated during low flow releases, particularly upstream of Texas Hole.

(6) Monitor and, if necessary, mitigate loss of native flannelmouth and bluehead suckers upstream of the Animas River confluence by establishing rearing habitats (e.g., grow-out ponds) as replacement stock for the San Juan River.

(7) Monitor associated changes in Navajo Reservoir fish species composition and abundance and mitigate for losses from self-sustaining fish populations by restocking.

(8) Develop area and capacity tables (1-2 ft (30-60 cm) intervals) for Navajo Reservoir to identify changes in availability of potential reservoir spawning habitat by species.

(9) Develop a monitoring plan to ensure success of mitigation measures and modify or replace unsuccessful projects. Unsuccessful projects could include gravel traps or in-stream structures that become dislodged or otherwise fail to function as proposed.

To minimize and/or avoid potential impacts (from future water projects developed by the Bureau):

(1) Ensure water quality by implementing the following measures:

a. Construction activities in the San Juan River should be conducted during low flow or low precipitation periods.

b. Construction work areas should be de-watered with coffer dams constructed of materials that cannot be brought into suspension by flowing water. Contain runoff from construction sites and contain any poured concrete in sealed forms and/or behind cofferdams to prevent discharge into the river. Place no surplus concrete within the 100-year floodplain. Contain and treat or remove waste-water from concrete batching, vehicle washdown, and aggregate processing.

c. Place only clean, coarse, and erosion-resistant fills in the water and employ silt curtains, settling basins, or other suitable means to control turbidity.

d. Store and dispense all fuels, lubricants, hydraulic fluids, and other petrochemicals above the 100-year floodplain. Inspect all equipment daily to ensure there are no leaks or discharges of lubricants, hydraulic fluids, or fuels. Contain and remove any petrochemical spills, including contaminated soil, and dispose of these materials at an approved upland disposal site.

(2) Revegetate temporarily disturbed construction areas with native vegetation following construction activities.

(3) Avoid impacting bald eagles during project activities. If bald eagles are found in the immediate project area during any construction period, the contractor should contact the Service to determine whether formal consultation under the Act is necessary.

(4) As water development in the basin continues, flexibility in implementing the flow recommendations will decrease. Therefore, to minimize impacts to (or potentially restore) resources upstream of the Animas River confluence, develop future water projects, where possible, between the Animas River confluence and the Shiprock gaging station. This would reduce the need and frequency of lower (less than 500 cfs (14 cms)) releases from Navajo Dam.

To improve overall fish and wildlife habitat in the project area upstream of the Animas River confluence:

(1) Manage riparian habitat for southwestern willow flycatcher. Management could include conservation easements, conservation agreements, land purchase, removal of non-native vegetation, and cowbird trapping.

(2) Monitor riparian areas to determine changes in riparian-wetland communities, particularly upstream of the Animas River confluence.

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Attachment A

Common and scientific names of fish species collected in the San Juan River project area downstream of Navajo Reservoir in San Juan County, New Mexico, Montezuma County, Colorado, and San Juan County, Utah

Common Name	**Scientific Name**
Threadfin shad	*Dorosoma petenense*
Red shiner	*Cyprinella lutrensis*
Common carp	*Cyprinus carpio*
Fathead minnow	*Pimephales promelas*
Speckled dace	*Rhinichtys osculus*
Black bullhead	*Ameiurus melas*
Channel catfish	*Ictalurus punctatus*
Green sunfish	*Lepomis cyanellus*
Longear sunfish	*Lepomis megalotis*
Bluegill	*Lepomis macrochirus*
Largemouth bass	*Micropterus salmoides*
White crappie	*Pomoxis annularis*
Yellow perch	*Perca flavescens*
Striped bass	*Morone saxatilis*
Walleye	*Stizostedion vitreum*
Western mosquitofish	*Gambusia affinis*
Plains killifish	*Fundulus zebrinus*
Flannelmouth sucker	*Catostomus latipinnis*
Bluehead sucker	*Catostomus discobolus*
Colorado pikeminnow	*Ptychocheilus lucius*
Razorback sucker	*Xyrauchen texanus*
Roundtail chub	*Gila robusta*
Mottled sculpin	*Cottus bairdi*
Rainbow trout	*Oncorhynchus gairdneri*
Brown trout	*Salmo trutta*
Kokanee salmon	*Oncorhynchus nerka*
Grass carp	*Ctenopharyngodon idella*

Attachment B

Common and scientific names of fish species collected in Navajo Reservoir in San Juan and Rio Arriba Counties, New Mexico, and Archuleta County, Colorado

Common Name	Scientific Name
Threadfin shad	*Dorosoma petenense*
Red shiner	*Cyprinella lutrensis*
Common carp	*Cyprinus carpio*
Fathead minnow	*Pimephales promelas*
Speckled dace	*Rhinichtys osculus*
Black bullhead	*Ameiurus melas*
Channel catfish	*Ictalurus punctatus*
Green sunfish	*Lepomis cyanellus*
Longear sunfish	*Lepomis megalotis*
Bluegill	*Lepomis macrochirus*
Largemouth bass	*Micropterus salmoides*
White crappie	*Pomoxis annularis*
Yellow perch	*Perca flavescens*
Striped bass	*Morone saxatilis*
Walleye	*Stizostedion vitreum*
Western mosquitofish	*Gambusia affinis*
Plains killifish	*Fundulus zebrinus*
Flannelmouth sucker	*Catostomus latipinnis*
Bluehead sucker	*Catostomus discobolus*
Colorado pikeminnow	*Ptychocheilus lucius*
Razorback sucker	*Xyrauchen texanus*
Roundtail chub	*Gila robusta*
Mottled sculpin	*Cottus bairdi*
Rainbow trout	*Oncorhynchus gairdneri*
Brown trout	*Salmo trutta*
Kokanee salmon	*Oncorhynchus nerka*

Attachment C

Common and scientific names of vegetation discussed or potentially occurring in the San Juan River project area in San Juan County, New Mexico, Montezuma County, Colorado, and San Juan County, Utah

Common Name	Scientific Name
Big bluestem	*Andropogon gerardi*
Little bluestem	*Schizachyrium scoparium*
Indian grass	*Sorghastrum nutans*
Wwitch grass	*Panicum virgatum*
Sideoats and other gramas	*Bouteloua* spp.
Harvard shin oak	*Quercus havardii*
Sand sagebrush	*Artemisia filifolia*
Soapweed yucca	*Yucca glauca*
Mesquites	*Prosopis glandulosa, P.torreyana*
Fourwing saltbush	*Atriplex canescens*
Rabbit brush	*Chrysothamnus* spp.
Cholla and pricklypear cactii	*Opuntia* spp.
Threadleaf groundsel	*Senecio longilobus*
Snakeweed	*Gutierrezia sarothrae*
Galleta grass	*Hilaria jamesii*
Indian ricegrass	*Oryzopsis hymenoides*
Western wheatgrass	*Agropyron smithii*
Hedgehogs	*Echinocereus* spp.
Prickly-pears and chollas	*Opuntia* spp.
Fremont cottonwood	*Populus deltoids*
Coyote willow	*Salix exigua*
Russian olive	*Eleagnus angustifolia*
Salt cedar	*Tamarix* spp.
Siberian elm	*Ulmus pumila*
Black locust	*Robinia pseudoacacia*
Honey locust	*Gleditisia triacantos*
Buttonbush[1]	*Cephalanthus* spp.
Boxelder[1]	*Acer* spp.
Goodding willow[1]	*Salix gooddingii*
Peachleaf willow[1]	*Salix amygdaloides*

[1] Not described as occurring in the project area.

Attachment D

Common and scientific names of mammals discussed or potentially occurring in the San Juan project area in San Juan County, New Mexico, Montezuma County, Colorado, and San Juan County, Utah

Common Name	Scientific Name
Pronghorn	*Antilocapra americana*
Mule deer	*Odocoileus hemionus*
Elk	*Cervus elaphus*
Desert bighorn sheep	*Ovis canadensis mexicana*
Red fox	*Vulpes vulpes*
Plains pocket mouse	*Perognathus flavenscens*
Desert cottontail rabbit	*Sylvilagus audubonii*
Black-tailed jack rabbit	*Lepus californicus*
Spotted ground squirrel	*Spermophilus spilosoma*
White-tailed antelope squirrel	*Ammospermophilus leucurus*
Rock squirrel	*Spermophilus variegatus grammurus*
Gunnison's prairie dog	*Cynomys gunnisoni*
Botta's pocket gopher	*Thomomys bottae*
Silky pocked mouse	*Peregnathus flavus*
Ords kangaroo rat	*Dipodomys ordii*
Banner-tailed kangaroo rat	*Dipodomys spectabilis*
Western harvest mouse	*Reithrodontomys megalotis*
Canyon mouse	*Peromyscus crinitus*
Deer mouse	*Peremyscus maniculatus*
Brush mouse	*Peremyscus boylii rowleyi*
Pinon mouse	*Peomyscus truei*
Northern grasshopper mouse	*Onychomys leucogaster*
White-throated woodrat	*Neotoma albigula*
Stephen'woodrat	*Neotoma stephensi*
Mexican woodrat	*Neotoma mexicana*
Bushy-tailed woodrat	*Neotoms cinerea*
House mouse	*Mus musculus*
Meadow vole	*Microtus pennsylvanicus*
Porcupine	*Erethizon dorsatum*
Coyote	*Canis latrans*
Kit fox	*Vulpes macrotis*
Grey fox	*Urocyon conereoargenteus scottii*
Striped skunk	*Mephitis mephitis*
Muskrat	*Ondatra zibethicus*
Colorado chipmunk	*Eutamias Quadrivittatus*
Beaver	*Castor canadensis*
Mountain lion	*Felis concolor*
Bobcat	*Lynx rufus*

Attachment E

Common and scientific names of birds discussed or potentially occurring in the San Juan River project area in San Juan County, New Mexico, Montezuma County, Colorado, and San Juan County, Utah

Common Name	Scientific Name
Mourning dove	*Zenaida mocroura*
Scaled quail	*Callipepla squamata pallida*
Gamble's quail	*Callipepla gambelii*
Red-tailed hawk	*Buteo jamaicensis*
Swainson's hawk	*Buteo swainsoni*
Rerruginous hawk	*Buteo regalis*
Golden eagle	*Aquila chrysaetos*
Marsh hawk	*Circus cyaneus*
Prairie falcon	*Falco mexicanus*
American kestrel	*Falco sparverius*
Common nighthawk	*Chordeiles minor*
White-throated swift	*Aerinautes saxatalis*
Black-chinned hummingbird	*Archilichus alexandri*
Broad-tailed hummingbird	*Selasporus platycercus*
Rufous hummingbird	*Megaceryle alcyon*
Common flicker	*Colaptes cafer*
Red-headed woodpecker	*Melanerpes erythrocephalus*
Eastern kingbird	*Tyrannus tyrannus*
Western kingbird	*Tyrannus verticalis*
Western flycatcher	*Empidonas difficilis*
Western wood pewee	*Contopus sordidulus*
Horned lark	*Eremophila alpestris*
Violet-green swallow	*Tachyconeta thalassina*
Rough winged swallow	*Stelgidopteryx ruficollis*
Barn swallow	*Hirundo rustica*
Scrub jay	*Aphelocoma coerulescens*
Pinyon jay	*Gymnorhinus cyanocephala*
Blacked-capped chickadee	*Parus atricapillus*
Black-billed magpie	*Pica pica*
American kestrel	*Falco sparverius*
Ring necked pheasant	*Phasianus colchicus*
Chukar	*Alectoris graeca*
Virginia rail	*Rallus limicola*
Sora	*Porzana carolina*
Common gallinule	*Callinula chloropus*
American coot	*Fulica americana*
Killdeer	*Charadrius vociferus*
Spotted sandpiper	*Actitis macularia*

Attachemnt E (continued)

Common Name	Scientific Name
American avocet	*Recurvirostra americana*
Ring-billed gull	*Larus delawarensis*
Yellow-billed cuckoo	*Coccyzus americanus*
Belted kingfisher	*Ceryle alcyon*
Loggerhead shrike	*Lanius ludovicianus*
Gray vireo	*Vireo vicinior*
Warbling vireo	*Vireo gilvus*
Virginia's warbler	*Vermivora virginiae*
Yellow warbler	*Dendroica petechia*
MacGillivray's warbler	*Oporornis tolmiei*
Yellowthroat	*Geothylpis trichas*
Yellow-breasted chat	*Icteria virens*
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*
Red-winged blackbird	*Agelaius phoeniceus*
Scott's oriole	*Icterus parisorum*
Bullock's oriole	*Icterus bullockii*
Brewer's blackbird	*Euphagus cyanocephalus*
Boat-tailed grackle	*Cassidix mexicanus*
Black-headed grosbeak	*Pheucticus melanocephalus*
Blue grosbeak	*Guiraca caerulea*
Indigo bunting	*Passerina cyanea*
Lazuli bunting	*Passerina ameona*
Pine siskin	*Spinus pinus*
Lark bunting	*Calamospiza melanocorys*
Lark sparrow	*Chondestes grammacus*
Black-throated sparrow	*Amphispiza bilineata*
Sage sparrow	*Amphispiza belli*
Chipping sparrow	*Spizella passerina*
House sparrow	*Passer domesticus*
House finch	*Carpodacus mexicanus frontalis*
Brown headed cowbird	*Molothrus ater*
Western meadowlark	*Sturnella meglecta*
Dark-eyed junco	*Junco hyemalis*
Western tanager	*Piranga ludoviciana*
European starling	*Sturnus vulgaris*
Grey catbird	*Dumetella carolinensis ruficrissa*
House wren	*Troglodytes aedon parkmannii*
Bewick's wren	*Thryomanes bewickii*
Long-billed marsh wren	*Telmatodytes palustris*

Common Name	Scientific Name
Rock wren	*Salpinctes obsoletus obseletus*
Mockingbird	*Mimus polyglottos*
Turkey vulture	*Catahartes aura*
Northern harrier	*Circus cyaneus hudsonius*
Screech owl	*Otus asio*
Great horned owl	*Bubo virginianus*
Burrowing owl	*Speotyto cunicularia*
Long-eared owl	*Asio otus*
Common raven	*Corvus corax sinuatus*
Bendire's thrasher	*Toxostoma bendirei*
Sage thrasher	*Oreoscoptes montanus*
American robin	*Turdus migratorius*
Cedar waxwing	*Bombycilla cedrorum*
Loggerhead shrike	*Lanius ludovicianus*
Common starling	*Sturnus vulgaris*
Pied-billed grebe	*Podilymbus podiceps*
Great blue heron	*Ardea herodias*
Green heron	*Butorides virescens*
Snowy egret	*Leucophoyx thula*
Black-crowned night heron	*Nycticorax nycticorax*
Least bittern	*Ixobrychus exilis*
American bittern	*Botaurus lentiginosus*
White-faced ibis	*Plegadis chihi*
Canada goose	*Branta canadensis*
Mallard	*Anas platyrhynchos*
Gadwall	*Anas strepera*
Cinnamon teal	*Anas cyanoptera*
American widgeon	*Marca americana*
Shoveler	*Spatula clypeata*
Blue-winged teal	*Anas discors*
Mississippi kite	*Actinia misisippiensis*
Bald eagle	*Haliaeetus leucocephalus*
Southwestern willow flycatcher	*Empidonax traillii extimus*

Attachment F

Common and scientific names of amphibians and reptiles discussed or potentially occurring in the San Juan River project area in San Juan County, New Mexico, Montezuma County, Colorado, and San Juan County, Utah

Common Name	Scientific Name
Amphibians	
Plains spadefoot	*Spea bombifrons*
New Mexico spadefoot	*Spea multiplicata*
Bullfrog	*Rana catesbeiana*
Northern leopard frog	*Rana pipiens*
Western chorus frog	*Pseudacris triseriata*
Woodhouse's toad	*Bufo woodhousii*
Tiger salamander	*Ambystoma tigrinum*
Reptiles	
Bullsnake	*Pituophis melanoleucus*
Western hognose snake	*Heterodon nasicus*
Trans-pecos rattle snake	*Bogerthophis subocularis*
Western rattlesnake	*Crotalus viridis*
Western terrestrial garter snake	*Thamnophis elegans*
Western plains milk snake	*Lampropeltis triangulum*
Blackneck garter snake	*Thamnophis crytopsis*
Lesser earless lizard	*Holbrookia maculata*
Collard lizard	*Crotaphytus collaris*
Lesser earless lizard	*Holbrookia maculate*
Eastern fence lizard	*Scelophorus undulatus*
Western whiptail	*Cnemidophorus tigris*
Plateau striped whiptail	*Cnemidophorus volex*
Least striped whiptail	*Cnemidophorus inornatus*
Side-blotched lizard	*Uta stansbutiana*
Tree lizard	*Urosaurus ornatus*
Sagebrush lizard	*Sceloporus graciosus*
Short horned lizard	*Phrynosoma douglasii*
Painted turtle	*Chrysemys picta*