US Army Corps
Of Engineers
Albuquerque District

FINDING OF NO SIGNIFICANT IMPACT
AND
ENVIRONMENTAL ASSESSMENT
FOR THE

PARTIAL EVACUATION OF THE SEDIMENT POOL AT JEMEZ CANYON RESERVOIR, SANDOVAL COUNTY, NEW MEXICO

U.S. Army Corps of Engineers
Albuquerque District
4101 Jefferson Plaza Northeast
Albuquerque, New Mexico 87109

September 2000

CONVERSION FACTORS

	From	Multiplier-->	To
Length	inches	25.4	millimeters
	feet	0.0348	meters
	miles	1.6093	kilometers
Area	acres	0.0407	hectares
	square miles	2.590	square kilometers
Volume	cubic yards	0.7646	cubic meters
	acre-feet	1233.5	cubic meters
	acre-feet	325,851	gallons
Flow	cubic feet/second (cfs)	0.0283	cubic meters/second
Mass (weight)	tons (short ton)	0.9072	metric tons
Velocity	feet/second	0.3048	meters/second
Salinity	µSiemens/cm or µmhos/cm	0.32379	parts/million NaCl or mg/liter NaCl
Temperature	° Fahrenheit	(°F-32)/1.8	° Celsius

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FINDING OF NO SIGNIFICANT IMPACT

PARTIAL EVACUATION OF THE SEDIMENT POOL AT JEMEZ CANYON RESERVOIR, SANDOVAL COUNTY, NEW MEXICO

The Jemez Canyon Dam and Reservoir Project was authorized by the Flood Control Acts of 1948 (P.L. 80-858) and 1950 (P.L. 81-516) for flood damage reduction and sediment retention. Construction of the dam began May 1950 and the facility was completed and placed into operation in October 1953. All lands associated with the Project are held in trust by the United States for the benefit and use of the Pueblo of Santa Ana.

The reservoir did not include a permanent pool for the first 26 years of operation. In 1979, the Corps and the New Mexico Interstate Stream Commission (NMISC) agreed to establish a 2,000 acre-foot sediment retention pool. To yet further improve sediment retention, the Corps and NMISC agreed in a 1986 Memorandum of Understanding (MOU) to store water within the remaining sediment storage space (up to elevation 5196.7 feet), as much as 29,712 acre-feet at that time. The NMISC leased San Juan-Chama Project water from the City of Albuquerque and its storage was facilitated by exchange with San Juan-Chama Project water released down the Rio Grande. The average size of Jemez Canyon Reservoir for the past 15 years has been about 1,200 acres.

The Corps-NMISC storage agreement will expire on December 31, 2000 (the MOU's original expiration date). Factors influencing this decision include significantly increased demands on available water in the region, it's increasing cost, and need for increased sediment loading to the currently degrading Rio Grande channel (which was aggrading in the 1930s through 1980s). The Corps-NMISC MOU states that, at the end of the agreement, the remaining sediment pool may be drawn down at the rate of 5,000 acre-feet per calendar year. According to the NMISC-City of Albuquerque lease agreement, ownership of the remaining water in the sediment pool reverts to the City.

The eventual termination of the sediment pool is not within the scope of the federal action evaluated in this Environmental Assessment. The Corps currently is conducting studies and will develop in 2001 a final plan to address environmental concerns and issues associated with terminating the sediment pool. These include: potential entrenchment of the Jemez River for 5.5 miles upstream from dam; water and wind erosion of potential contaminants in exposed sediments; problems with proper flood gate closure due to sediment; revegetation and grazing within the reservoir area; and the Government's stewardship and trust responsibilities.

In November 1999, a coalition of environmental groups filed suit (*Rio Grande Silvery Minnow, et al,. vs. Eluid L. Martinez, et al.*) against the U.S. Government for failure to comply with the Endangered Species Act relative to planned water operations and river maintenance activities along the Rio Grande and its tributaries. In response to much lower-than-average flows during 2000, the plaintiffs requested a preliminary injunction to maintain flows in the middle Rio Grande in a manner which would be sufficient to prevent the river from drying, particularly in the reach below the San Acacia Diversion Dam. In lieu of an injunction, the U.S. District Court ordered mediation amongst all parties (plaintiffs, defendants [U.S. Bureau of Reclamation and U.S. Army Corps of Engineers], and defendant-intervenors [State of New Mexico, Middle Rio Grande Conservancy District, and City of Albuquerque]. An Agreed Order (dated August 2, 2000) provides for up to 85,900 acre-feet of water to meet the objective of maintaining river flows, which specifically includes up to 12,000 acre-feet from the current sediment pool in Jemez Canyon Reservoir.

Release of water from the reservoir would require the Corps and NMISC to amend the 1986 sediment pool storage MOU to allow up to 12,000 acre-feet to be released in 2000, and approval of a deviation from the current water control plan from South Pacific Division of the Corps. These federal actions entail the need for this Environmental Assessment (EA).

The proposed action evaluated in this EA entails the method, timing, and potential effects of the release of 12,000 acre-feet of water from the reservoir during September through October 2000. The proposed plan is compared to the method, timing, and potential effects of the no-action alternative of releasing up to 5,000 acre-feet

per calendar year during 2001 and 2002. Because no formal proposals for the continuation of storage for sediment retention at Jemez Canyon Reservoir have been proffered by regional water management entities, that action was not considered a reasonable alternative for evaluation in this EA.

The proposed plan would release up to 12,000 acre-feet from the current approximately 17,000 acre-foot sediment pool at Jemez Canyon Reservoir in September through October 2000. Releases would be made at the lowest discharge rates practicable (ranging from 150 to 600 cfs) to facilitate timely delivery. All release would be coordinated with natural flow and discharges from other reservoirs in the Rio Grande system. The proposed plan includes several measures to avoid, minimize, or compensate for potential adverse effects. As soon as practicable after the release of 12,000 acre-feet, temporary vegetative cover would be established on approximately 500 acres of the exposed sediment bed to minimize erosion by wind or water. Detailed sampling and analysis of the constituents in water, sediment, and biota would begin early in FY01 to determine if metal concentrations pose any health risk to humans. Approximately 200 head of cattle would immediately be relocated to temporary enclosures to prevent their demise in exposed, saturated sediments, and to prevent disturbance of the temporary vegetative cover. Supplemental feed and water would be provided to cattle for up to 9 months until irrigated pastures could be established. Beginning in early 2001, a 3.3-mile-long channel would be excavated within the upper portion of the reservoir to prevent severe headcutting by spring snowmelt runoff and to maintain the current river bed elevation to a degree that would prevent significant deterioration of wetland and riparian communities in the reservoir's delta area. Fish would be salvaged from the remaining sediment pool in 2001 and, due to concerns about elevated mercury concentrations, would likely be disposed of through burial in an appropriate location.

Prior to implementation of channel excavation under the proposed plan, an individual permit relative to Section 404 of the Clean Water Act would be obtained from the Albuquerque District Regulatory Branch, and a Section 401 Water Quality Certification Permit would be obtained from U.S. Environmental Protection Agency Region 6.

The potential effects and measures to avoid potentially significant adverse effects included in the proposed plan are largely similar to those of the no-action alternative, with the exception of timing. Under the proposed plan, effects would become substantive six to twenty months sooner than under the no-action scenario.

In consideration of the relative effects to the human environment evaluated in this Environmental Assessment, the proposed plan is recommended for implementation. Measures to avoid potentially significant effects will be initiated immediately and will continue as soon as funding becomes available. The total amount of funding is not currently available but is expected in early FY 2001 in time to prevent any potentially significant effects.

The planned action has been fully coordinated with federal, state, and tribal agencies with jurisdiction over the ecological, cultural, and hydrologic resources of the project area. Based upon these factors and others discussed in detail in the Environmental Assessment, the planned action would not have a significant effect on the human environment. Therefore, an Environmental Impact Statement will not be prepared for the conduct of the partial evacuation of the sediment pool at Jemez Canyon Reservoir.

Raymond G. Midkiff,
Lieutenant Colonel, EN
District Engineer

September 19, 2000
Date

ENVIRONMENTAL ASSESSMENT FOR THE
PARTIAL EVACUATION OF THE SEDIMENT POOL AT JEMEZ CANYON RESERVOIR, SANDOVAL COUNTY, NEW MEXICO

TABLE OF CONTENTS

PLATES *Alternate file names*

APPENDICES *appendix.doc / _.pdf / _.htm*

LIST OF TABLES

ENVIRONMENTAL ASSESSMENT FOR THE PARTIAL EVACUATION OF THE SEDIMENT POOL AT JEMEZ CANYON RESERVOIR, SANDOVAL COUNTY, NEW MEXICO

1. INTRODUCTION

1.01 BACKGROUND AND NEED

On December 5, 1997, the Albuquerque Area Office of the Bureau of Reclamation (Bureau), the Albuquerque District of the U.S. Army Corps of Engineers (Corps), and the New Mexico Ecological Services Office of the U.S. Fish and Wildlife Service (Service) began informal consultation pursuant to Section 7 of the Endangered Species Act (16 U.S.C. 1531 *et seq*, as amended) regarding potential effects of anticipated water operations and river maintenance activities on federally protected species in or near the Rio Chama and Rio Grande from Heron Reservoir and Velarde, New Mexico, respectively, downstream to the headwaters of Elephant Butte Reservoir over an approximate 5-year period. The Bureau and the Corps jointly submitted a Programmatic Biological Assessment to the Service in May 1998 (U.S. Department of the Interior and U.S. Department of the Army, 1998). A revised Programmatic Biological Assessment was submitted in October 1999 (U.S. Department of the Interior and U.S. Department of the Army, 1999). The primary federally protected species addressed were the Rio Grande silvery minnow and the Southwestern Willow Flycatcher. A Biological Opinion has not been issued by the U.S. Fish and Wildlife to date.

On November 15, 1999, a coalition of environmental organizations – The Defenders of Wildlife, Forest Guardians, National Audubon Society, New Mexico Audubon Council, Sierra Club, and Southwestern Environmental Center – filed a lawsuit (*Rio Grande Silvery Minnow, et al,. vs. Eluid L. Martinez, et al.*) against the Bureau of Reclamation and the Corps of Engineers for failure to comply with the Endangered Species Act regarding water operations and river maintenance activities. On April 10, 2000, in response to a much lower-than-average spring runoff in the Middle Rio Grande, the environmental organizations filed a Motion for Preliminary Injunction to maintain flows in the Middle Rio Grande in a manner which would be sufficient to prevent the river from drying, particularly in the San Acacia reach, and to facilitate silvery minnow spawning. Defendant-Intervenors in the suit included the Middle Rio Grande Conservancy District, the State of New Mexico, and the City of Albuquerque. In lieu of an injunction, the U.S. District Court, District of New Mexico, ordered mediation amongst all parties which resulted in an Agreed Order, dated August 2, 2000, to resolve the plaintiff's motion in a manner that:

> "… (1) reduces the risk that conditions in the Middle Rio Grande Basin for the remainder of the year 2000 will lead to the extinction of the Rio Grande silvery minnow;
> (2) contributes to the long-term efforts to promote the continued existence and recovery of the silvery minnow and to avoid adverse modification of the minnow's designated critical habitat;
> (3) best addresses and protects the interests and needs of all interested parties in the Middle Rio Grande Valley;
> (4) recognizes hydrologic realities and the limited water supply that exists in the basin; and
> (5) is consistent with applicable provisions of New Mexico and federal law, and the relevant interstate compacts."

The Agreed Order (see Appendix A of this Environmental Assessment) provides for 85,900 acre-feet of water to meet these objectives. Specifically included in this amount is 12,000 acre-feet from the current sediment pool in Jemez Canyon Reservoir, a facility built and operated by the Corps of Engineers. The current sediment pool[1] was established by a 1986 Memorandum of Understanding (MOU) between the Corps and the New Mexico Interstate Stream Commission (NMISC) to provide for the storage of water within Jemez Canyon Reservoir for sediment retention (see Appendix B of this Environmental Assessment). The NMISC leased water for the initial filling and subsequent annual replacement of evaporation and seepage losses from the City of Albuquerque, using a portion of the City's San Juan-Chama Project allocation.

Independent of the legal proceedings discussed above, the Corps-NMISC storage agreement will expire on December 31, 2000, the MOU's original expiration date. The NMISC has decided not to extend the agreement for sediment pool storage, citing significantly increased demands on available water in the region, it's increasing cost, and the need for increased sediment loading to the currently degrading Rio Grande channel as factors in this decision. According to the agreement between the NMISC and the City of Albuquerque, ownership of the remaining water in the sediment pool reverts to the City. The Corps-NMISC MOU states that, at the end of the agreement, the remaining sediment pool in Jemez Canyon Reservoir may be drawn down at the rate of 5,000 acre-feet per calendar year. (On September 19, 2000, the sediment pool will contain approximately 17,000 acre-feet of water.)

To release the required water from the Jemez Canyon Reservoir sediment pool, and to comply with the Agreed Order and the Corps' responsibilities under the Endangered Species Act, the Corps-NMISC MOU must be amended to allow up to 12,000 acre-feet to be withdrawn during calendar year 2000, and the Albuquerque District must obtain approval from the Corps' South Pacific Division for a deviation of the existing water control plan. Pursuant to Engineer Regulation 1110-2-240, *Water Control Management*, deviations in the approved water control plan require compliance with the National Environmental Policy Act and all other appropriate laws and regulations.

1.02 PURPOSE AND SCOPE

The proposed action evaluated in this Environmental Assessment (EA) is the release of 12,000 acre-feet of water from Jemez Canyon Reservoir during calendar year 2000. The no-action alternative is the release of that water as stated in the Corps-NMISC MOU – in increments not to exceed 5,000 acre-feet per year during calendar years 2001 and 2002 – with no replacement of the additional water lost to evaporation and seepage. (These alternatives are described in detail in Section 2 of this EA.)

The alternatives considered in this EA relate only to the water currently stored in Jemez Canyon Reservoir and its method and timing of release. The Jemez Canyon Dam and Reservoir Project will continue to operate under its existing Congressional authorization for flood and sediment control.

The continuation of the current sediment pool is not a reasonably foreseeable alternative in this EA. The 1986 Corps-NMISC MOU for storage will expire and no other entity has expressed an interest in providing water to maintain storage for sediment control purposes. Neither the proposed action nor the

[1] The term "sediment pool" is used in this document to refer to the actual water in storage; "sediment space" refers to the area (or volume) below elevation 5196.7 feet which has been designated for eventual sediment deposition.

expiration of the current MOU precludes the possibility of establishing a "new" sediment pool at Jemez Canyon Reservoir.

1.03 RELATIONSHIP TO OTHER ACTIONS

The Corps currently is formulating a mitigation plan to address the physical termination of the sediment pool at Jemez Canyon Reservoir. The following activities are anticipated during fiscal year 2001:

* Detailed analysis of geomorphic, hydrologic, and ecologic conditions both upstream and downstream from Jemez Canyon Dam;
* Sampling and analysis of constituents in water, sediments, and biota;
* Analysis and design of structural improvements to the dam outlet works which would facilitate their safe operation for flood control under a changed sediment transport regime;
* Revision of the current Water Control Manual to reflect the change in storage conditions;
* Coordination and cooperation with the Pueblo of Santa Ana to facilitate their revised resource management plans on tribal lands within the former sediment pool and associated areas;
* Planning and compliance for implementation of the final mitigation plan.

These foreseeable future actions are discussed in more detail in Section 4.03.

1.04 REGULATORY COMPLIANCE

This Environmental Assessment was prepared by the U.S. Army Corps of Engineers, Albuquerque District, in compliance with all applicable Federal statutes, regulations, and Executive Orders, including:

National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4321 *et seq*.);
Regulations for Implementing the Procedural Provisions of NEPA (40 CFR 1500 *et seq*.);
U.S. Army Corps of Engineers' Procedures for Implementing NEPA (33 CFR 230);
Clean Air Act, as amended (42 U.S.C. 7401 *et seq*.);
Clean Water Act of 1977, as amended (33 U.S.C. 1251 *et seq*.);
Endangered Species Act, as amended (16 U.S.C. 1531 *et seq*.);
Protection of Wetlands (Executive Order 11990).
National Historic Preservation Act, as amended (16 U.S.C. 470 *et seq*.);
Protection of Historic Properties (36 CFR 800 *et seq*.);
Protection and Enhancement of the Cultural Environment (Executive Order 11593);
American Indian Religious Freedom Act (42 U.S.C. 1996); and
Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. 3001 *et seq*.).

This document and associated analyses have been coordinated with the Pueblo of Santa Ana. For those portions of the proposed action potentially affecting non-tribal lands, this document also reflects compliance with applicable State of New Mexico regulations and standards for water quality, as well as regulations conserving endangered plants and animals. Likewise, the document reflects compliance with water quality standards for Sandia Pueblo.

2. DESCRIPTIONS OF THE NO-ACTION ALTERNATIVE THE AND PROPOSED PLAN

2.01 BACKGROUND FACTORS COMMON TO BOTH ALTERNATIVES

The following sections describe the basic scenarios of evacuation of the Jemez Canyon Reservoir sediment pool under the no-action and proposed alternatives.

The prediction of pertinent Jemez Canyon Reservoir characteristics under the no-action and proposed plans were modeled by the Albuquerque District Reservoir Control Branch using Riverware™ river-reservoir simulation software. All scenarios are based on reasonable conditions using data from past reservoir operation. However, the data presented here are predictions – actual capacity and area values may vary from predicted values by ±10%. Evacuation scenarios for both plans are summarized in Plate 1 and Table 1.

[Readers are reminded that information regarding the status and operation of all Albuquerque District reservoirs are posted daily to the District's web page: http://www.spa.usace.army.mil/ .]

Inflow hydrographs from August 1995 to August 1997 were included in the model simulations for completeness; however, inflow rates generally will be inconsequential to the future condition of the sediment pool. After the expiration of the sediment pool, Jemez Canyon Dam will pass all inflow except the larger events which invoke the need for flood control operation.

To minimize potential adverse effects which may result from abrupt changes in discharge rates, all reservoir releases referred to below would be increased gradually ("ramped") at the start of release and incrementally ramped down at the end. Ramping increments will depend on the release rate selected.

All releases discussed will adhere to the Rio Grande Compact and the *Master Flood Control Regulation Manual, Rio Grande Basin above Elephant Butte Reservoir* (USACE 1985), and will be coordinated with the operation of and releases from upstream reservoirs.

Relevant to both plans is the fact that the expiration of the current sediment pool agreement and the cessation of water impoundment for sediment control will not terminate the authorized purposes or operation of Jemez Canyon Dam for sediment and flood control. The facility will continue to operate to achieve the stated purposes (although sediment trap efficiency would decrease with the eventual loss of the sediment pool).

2.02 NO-ACTION ALTERNATIVE

The Memorandum of Understanding (MOU) between the Corps and New Mexico Interstate Stream Commission (NMISC) for storage of water for sediment control in Jemez Canyon Reservoir will expire on December 31, 2000. The City of Albuquerque could withdraw its water remaining in the pool at a rate not to exceed 5,000 acre-feet per calendar year. The time period analyzed under the no-action plan entails the reservoir drawdown period which would extend into 2002.

As of September 19, 2000, the approximate size of the sediment pool would be 16,921 acre-feet (965 acres; refer to Table 1 throughout this discussion). Water would be lost to evaporation and seepage

such that the pool on January 1, 2001, would be about 15,940 acre-feet (919 acres). During calendar year 2001, up to 5,000 acre-feet would be released at the request of the City of Albuquerque. It was assumed that this release would occur at the start of August (the typical time of year for such requests) and would be released at a rate of approximately 200 cfs for two weeks. In mid-August, the pool would be approximately 7,485 acre-feet (762) acres in size, and would decrease over the following year due to evaporation and seepage. During August 2002, the remaining pool of approximately 4,707 acre-feet (459 acres) would be released at the request of the City.

In actuality, the City of Albuquerque may request withdrawal of their water at any time during a particular calendar year -- the August period described here is simply the most reasonable scenario. The Corps would likely accommodate such a request as long as the timing of release would not be contrary to flood control operation of the Middle Rio Grande reservoir system.

Table 1. Predicted characteristics of the Jemez Canyon Reservoir under the no-action and proposed plans.

	No Action			Proposed Plan		
Date	Elevation (ft, NGVD)	Capacity (acre-feet)	Area (acres)	Elevation (ft, NGVD)	Capacity (acre-feet)	Area (acres)
September 19, 2000	5,189.55	16,921	965	5,189.55	16,921	965
	Evaporation and seepage loss.			***Release of 12,000 ac-ft.***		
October 31, 2000	5,189.21	16,597	943	5,174.45	4,921	488
	Evaporation and seepage loss.			*Evaporation and seepage loss.*		
January 1, 2001	5,188.51	15,940	919	5,173.60	4,469	438
	Evaporation and seepage loss.			*Evaporation and seepage loss.*		
August 1, 2001	5,184.63	12,485	863	5,169.83	2,924	378
	Release of 5,000 ac-ft.			***Release of remaining water.***		
August 15, 2001	5,178.82	7,485	762	5,156.25	0	0
	Evaporation and seepage loss.					
January 1, 2002	5,177.62	6,830	745	5,156.25	0	0
	Evaporation and seepage loss.					
August 1, 2002	5,174.12	4,707	459	5,156.25	0	0
	Release of remaining water.					
August 15, 2002	5,156.25	0	0	5,156.25	0	0

Note: All values and dates are approximate.

2.03 PROPOSED PLAN

To meet the requirements of the U.S. District Court Agreed Order, 12,000 acre-feet would be released from the Jemez Canyon Reservoir sediment pool during September-October 2000, following an amendment to the current Corps-NMISC storage agreement and the approval of a deviation in the existing water control plan for the facility by the South Pacific Division of the U.S. Army Corps of Engineers.

Based on current precipitation patterns, expected irrigation water demand, and the schedule for transport of water identified in the Agreed Order, releases from Jemez Canyon Reservoir would begin on or after September 19, 2000, and would be completed by October 31, 2000. All releases from Jemez

Canyon Reservoir would be coordinated with other releases pertaining to the Agreed Order made from other middle Rio Grande system reservoirs, as well as natural flows from precipitation.

Releases from Jemez Canyon Dam are expected to be made at rates ranging from 150 to 400 cfs, but may be as high as 600 cfs if necessary for timely delivery. The duration of release of the entire 12,000 acre-feet would range from 2 to 6 weeks. The combined discharge of the Rio Grande downstream from the confluence of the Jemez River is expected to be approximately 1,100 cfs in September and 950 cfs in October.

It is the Corp's explicit objective to release Jemez Canyon Reservoir water at as low a discharge rate as practicable. A relatively slow drawdown rate would: (1) minimize the potential for channel erosion in the upper reservoir; (2) lower the probability that shifting sediment deposits would impinge upon the dam's control gates; (3) minimize the possibility of transport of fish through the dam; (4) minimize potential bank erosion along the Jemez River channel below the dam; and (5) minimize effects on Bureau of Reclamation construction activities planned to occur along the Rio Grande immediately downstream from the Jemez River confluence.

Inflow to Jemez Canyon Reservoir may slightly affect the duration of the release of 12,000 acre-feet. Jemez Canyon Dam is operated such that all natural flow into the reservoir must be released before stored San Juan-Chama Project water (the current sediment pool). Precipitation producing runoff in the Jemez River would simply extend the duration of release of 12,000 acre-feet from the pool. Additionally, if runoff from precipitation in upstream portions of the middle Rio Grande watershed were of sufficient quantity to affect irrigation and supplemental water demands, releases from Jemez Canyon Reservoir would be adjusted to take advantage of the increased mainstem flows.

Anticipated changes in Jemez Canyon Reservoir characteristics under the proposed plan are summarized in Plate 1 and Table 1. As of September 19, 2000, the approximate size of the sediment pool would be 16,921 acre-feet (965 acres). A total of 12,000 acre-feet would be released (subject to the factors affecting the planned releases discussed above) such that the remaining sediment pool would be approximately 4,921 acre-feet (488 acres) in size on October 31. During the release of 12,000 acre-feet, the sediment pool would decrease by approximately 477 acres and the water surface elevation would be lowered about 14 feet.

The remaining San Juan-Chama water in the sediment pool would be lost or released in accordance with original terms of the Corps-NMISC MOU. In August 2001, the sediment pool would be approximately 2,924 acre-feet (378 acres) in size, and it is anticipated that the City of Albuquerque would request its release at that time. Therefore, the Jemez Canyon sediment pool is expected to be fully evacuated by August 2001, approximately one year earlier than anticipated under the no-action plan. As stated previously, the City may request the release of remaining water at any time after December 31, 2000; however, the release of the last few hundred acre-feet of the pool must be closely coordinated with the Corps and the Pueblo of Santa Ana to facilitate planned mitigative actions, including fish salvage or disposal.

The proposed plan includes several measures to avoid, minimize, or compensate for potential adverse effects. As soon as practicable after the release of 12,000 acre-feet, temporary vegetative cover would be established on approximately 500 acres of the exposed sediment bed to minimize erosion by wind or water. Detailed sampling and analysis of the constituents in water, sediment, and biota would begin early in FY01 to determine if metal concentrations pose any health risk to humans. Approximately 200

head of cattle would immediately be relocated to temporary enclosures to prevent their demise in exposed, saturated sediments, and to prevent disturbance of the temporary vegetative cover. Supplemental feed and water would be provided to cattle for up to 9 months until irrigated pastures could be established. Beginning in January 2001, a 3.3-mile-long channel would be excavated within the upper portion of the reservoir to prevent severe headcutting by spring snowmelt runoff. The final channel design and remaining compliance activities (*e.g.*, Clean Water Act permitting) would be accomplished in October through December 2000. Fish would be removed from the remaining sediment pool in 2001 and, due to concerns about elevated mercury concentrations, would likely be disposed of through burial in an appropriate location. Additional details on these features of the proposed plan are included in the discussion of potential effects in Section 4.01.

3. EXISTING ENVIRONMENT

3.01 JEMEZ CANYON DAM AND RESERVOIR PROJECT

The Jemez Canyon Dam and Reservoir Project is located on the Jemez River, 2.8 miles upstream from its confluence with the Rio Grande. It is situated in Sandoval County, about 5 miles northwest of Bernalillo, New Mexico, and about 22 miles north of Albuquerque. The Jemez River enters the Rio Grande about 24 miles below Cochiti Dam. The project location is shown on Plate 2 and the watershed map is shown on Plate 3.

Congressional authority for the construction of Jemez Canyon Dam is contained in the Flood Control Acts of 1948 (P.L. 80-858) and 1950 (P.L. 81-516). The facility regulates Jemez River flows for flood damage reduction and sediment retention. Construction of the dam began in May 1950, and it was completed and placed into operation in October 1953. Pertinent dates are shown in Table 2.

Table 2. Pertinent construction dates, Jemez Canyon Dam and Reservoir project.

Feature	Began	Completed
Access Road	May 1950	August 1950
Outlet Works	August 1950	March 1951
Cofferdam	June 1952	July 1952
Embankment and Spillway	August 1952	October 1953
Santa Ana Pueblo Protection Works	April 1953	May 1954
Modifications to Dam and Spillway	March 1986	February 1987

All lands associated with the Jemez Canyon Dam and Reservoir Project (about 6,711 acres) are held in trust by the United States for the benefit and use of the Pueblo of Santa Ana. The Department of the Army and the Pueblo signed an MOU in 1952 (amended in 1978 by P.L. 95-498) which established a perpetual right and privilege for the construction, operation, and maintenance of the Jemez Canyon Dam and Reservoir Project. The Pueblo of Santa Ana reserved the right to use all associated lands for any purposes not inconsistent with those expressly granted to the government for the facility.

The dam is a rolled earth-fill structure with a crest length of 861 feet and a crest width of 23 feet. The project was modified as the result of revised probable maximum precipitation data and included raising the dam approximately 14 feet and widening the spillway 28 feet. This modification was completed in February 1987. Part of the dam raise included a 3-foot-tall concrete parapet wall at the upstream edge of the embankment crest to provide freeboard and control wave action. (Additional pertinent data for the Jemez Canyon Dam and Reservoir Project is included in Appendix C.)

Top-of-dam elevation is 5,271.6 feet (NGVD), which is approximately 149 feet above the original streambed. The outlet works are located in the left abutment and consist of an intake structure, modified 13-foot-diameter circular conduit, and stilling basin. The intake structure is a wet well tower with upstream trash rack, two gated openings, and operating deck at elevation 5,252.5 feet. Intake floor elevation is 5,125 feet. The modified circular conduit is 13 feet in diameter and 596.5 feet long, with a slope of 0.01676. The stilling basin is 80 feet wide and 70 feet long, with a level floor at an elevation of

5,076 feet. There are two rows of 3-foot-tall baffle blocks spaced 6 feet on center. The end sill is a 3-foot wall with a crest elevation of 5,079 feet. Capacity at maximum water surface is 9,700 cfs. An emergency spillway is located in a natural saddle about one-half mile south of the dam. It is 428 feet wide with 1 (vertical) on 2 (horizontal) side slopes and is approximately 3,900 feet long with a bottom elevation of 5,220 feet. Control is provided by a concrete ogee weir 50 feet wide with a crest elevation at 5,232 feet.

The reservoir at spillway crest (elevation 5,232 feet) is about 6 miles long and 1 mile wide. Initial capacity allocations were 73,000 acre-feet for flood control and 44,000 acre-feet for sediment deposition. Table 3 shows the area and capacity for initial conditions and subsequent surveys.

Table 3. Changes in reservoir area and capacity.

		Original		1975		1983		1991	
Feature	Elevation (ft., NGVD)	Area (ac.)	Capacity (ac-ft)	Area (ac.)	Capacity (ac-ft)	Area (ac.)	Capacity (ac-ft)	Area (ac.)	Capacity (ac-ft)
Top of Dam	5257.5	4440	210,082	4373	198,200	4373	194,800	4373	192,573
Max. Water Surface	5252.3	4147	187,752	4062	176,200	4062	172,800	4062	170,615
Spillway Crest	5232.0	2895	117,213	2877	106,100	2870	102,700	2954	100,485

Note: Some data represent pre-dam modification conditions.

The Santa Ana Pueblo levee is a related control facility and is located at the upper end of the reservoir. It was constructed to protect the old Pueblo from inundation during high reservoir stages. The levee is a compacted earth structure 2,900 feet long that partially encircles the pueblo. The top of the levee is at elevation 5,245.5 feet and the maximum height is about 23.5 feet. A toe drain on the landside is provided and seepage and interior drainage removal is accomplished by a pumping station constructed on the landside of the levee. In order to reduce the required pumping capacity, the interior drainage was reduced by the construction of hillside intercepting ditches immediately above the pueblo (USACE 1994).

Jemez River flows are passed through Jemez Canyon Dam with little, if any, regulation. Reservoir releases are restricted to the maximum non-damaging capacity of the downstream channel of the Rio Grande, as measured at Albuquerque, up to 7,000 cfs (USACE 1994). When the passage of inflow to the reservoir would exceed the channel capacity of the Rio Grande downstream, flood control storage is initiated. Flood waters are stored only for the duration needed to evacuate the water as rapidly as downstream conditions permit. Operation of Jemez Canyon Dam for flood control is coordinated with Cochiti and Galisteo Dams in order to regulate for the maximum safe flow at Albuquerque. Deviations to the existing water control plan which are not deemed an emergency require approval by South Pacific Division of the Corps and (except for San Juan Chama Project water) concurrence by each of the Rio Grande Compact Commissioners.

Flood storage is normally associated with snowmelt runoff during April through June. Summer flood storage is generally the result of short-term, high intensity thunderstorm events. The maximum storage to date has been 72,254 acre-feet (elevation 5,220.3 feet), occurring in 1987.

The Rio Grande downstream from the Jemez River confluence was an aggrading channel; that is, sufficient sediment had accumulated within the channel through Albuquerque by 1960 to raise the river bed 6 to 8 feet above the typical valley floor elevation outside of the levee system (Lagasse 1980). Initial operation for sediment retention in Jemez Canyon Reservoir was to maintain a 24-hour equivalent pool when inflow exceeded 40 cfs. This was effective in trapping sand and larger particles but let clay and most of the silt pass through the dam. Subsequent reworking of material deposited in the reservoir by low flows carried material through the conduit thus reducing trap efficiency and effectiveness of the project to prevent sediment building up in the channel downstream and in the Rio Grande channel. In addition, the pool was of insufficient size so that deposition occurred in the intake structure and against the gates, causing very difficult operation.

In the spring of 1979, the Corps and the New Mexico Interstate Stream Commission (NMISC) established a sediment retention pool of about 2,000 acre-feet at Jemez Canyon Reservoir using water exchanged from the San Juan-Chama Project. This pool significantly improved the sediment retention. In January 1986 the sediment retention pool was expanded to include the entire unused capacity of the allocated sediment space to further improve trap efficiency of the reservoir. The water for this expansion (currently a maximum of about 24,425 acre-feet) was again obtained through exchange for water from the San Juan-Chama Project leased from the City of Albuquerque by the NMISC. The pool was created and is maintained by capturing native water from the Jemez River in the reservoir and replacing that water to the Rio Grande by releasing San Juan-Chama Project water from upstream storage, usually during the spring runoff period. During the summer, reservoir inflow is very low, and the pool elevation begins to drop due to evaporative and seepage losses. A Memorandum of Understanding was executed between the NMISC and the Corps concerning the maintenance of the sediment pool and expires on December 31, 2000 (Appendix B of this Environmental Assessment). The MOU currently limits drawdown of the sediment retention pool at the end of the agreement to a maximum of 5,000 acre-feet per year.

3.02 GEOLOGY

The dam and reservoir are located entirely within an outcrop of the Santa Fe formation, a Miocene-Pliocene series of the Tertiary system. In the immediate area of the dam and well above the dam height, the Santa Fe formation is overlain unconformably by a basalt cap of Quaternary age. Within the reservoir area there is a minimal amount of basalt talus. The Santa Fe formation is composed of clay, silt, sand, gravel, and cobbles. The formation at the site is generally horizontally bedded; however, the beds are discontinuous both vertically and horizontally. Bank storage due to impoundment occurs within the Santa Fe formation or the overlying Quaternary sediments, primarily sand and gravel.

A series of north-south trending faults about three-quarters of a mile apart can be observed in the basalt cap in the vicinity of the dam. A fault strikes across the dam axis from just downstream of the right abutment and appears just upstream of the left abutment. Displacement in the Santa Fe formation is not readily discernible because of the unconsolidated character of the formation. Faulting in unconsolidated or poorly consolidated and discontinuous lenses leaves no significant change in the material as would occur in bedrock. There is no record of recent seismic activity in the area.

The dam is located across a constriction of a canyon cut by the Jemez River about two miles above its confluence with the Rio Grande. The canyon is about 250 feet wide at stream level and 1,100 feet wide at the crest. The depth of the canyon is about 275 feet at the left abutment, and 325 feet at the right abutment. Immediately upstream of the dam the valley widens considerably.

3.03 SOILS

Soils of four major associations are found in the Jemez Dam and Reservoir Project area. Christianburg-Navajo soils occur principally along the floor of the Jemez River valley. They are nearly level, fine-textured alluvium weathered from shale and sandstone and are highly susceptible to erosion. These soils encompass nearly the entire flood pool area of the reservoir (*i.e.*, below elevation 5,232 feet) as well the floor of Jemez Canyon downstream from the dam.

Soils of the Sheppard-Rough-Broken-Land association occur on the rolling uplands, are developing from the Santa Fe sandstone formation, and, in parts of the project area, are being reworked extensively by wind. The soils are deep and have a brown loamy sand surface layer and a pale brown loamy sand subsoil and substratum. Lands to the south of the reservoir and the spillway (as well as the spillway area itself) consist of this soil type.

Rough-Broken-Land-Embudo association soils comprise the very steep slopes between the mesa tops and the valley floor. These include the slopes encircling the public use area, those along both sides of Jemez Canyon downstream from the dam, and the escarpment immediately north of the entire reservoir area. The soils of this association generally are forming in old, unconsolidated alluvium and are usually overlaid by large chunks of extruded basalt that have broken off the cap formed by old lava flows. Gravel and cobbles are common over much of the surface.

Soils of the Apache-Silver-Rockland association occur primarily on the mesa tops and are forming in materials of volcanic origin on very old lava flows. In the project area this association is represented by Apache soils, which typically are shallow and stony. The brown granular surface layers contain variable amounts of angular and semi-rounded fragments of basalt, which become increasingly abundant with depth. The public use area and project office are situated within this soil type.

3.04 CLIMATE AND HYDROLOGY

Climate of the Jemez River Basin is characterized by hot summers with a large diurnal range in temperature. Winters vary from moderate in the lower basin to severe in the higher mountainous area. The spring and fall transition seasons are usually very short. Change from summer to winter is characterized by the disappearance of thunderstorm activity followed by clear weather, which dominates between winter frontal passages. During the summer, northern New Mexico has a higher frequency of thunderstorms than most areas in the United States. Thunderstorms are most active during July and August and usually reach peak activity in late afternoon.

The average annual precipitation over the Jemez River Basin, based on National Weather Service stations in and adjacent to the basin, is about 17.0 inches. The Jemez Springs rainfall station recorded a maximum annual precipitation of 28.72 inches in 1957 and a minimum of 6.17 inches in 1956. The maximum recorded 24-hour rainfall was 3.24 inches on October 5, 1911. Since the installation of the weather station at Jemez Canyon Dam in 1954, the maximum annual precipitation was 13.88 inches in 1987 and the minimum was 2.40 inches in 1956. The maximum recorded 24-hour rainfall was 2.75 inches on October 17, 1960. Monthly and annual variations in precipitation for Jemez Canyon Dam, Wolf Canyon, Jemez Springs, and Los Alamos, New Mexico, are shown in Tables 4 and 5, respectively. Mean annual precipitation in the Jemez River Basin varies from 8.35 inches at Jemez Canyon Dam to more than 30 inches in the high mountainous regions of the basin. About one-third of the annual precipitation occurs during July and August as thunderstorms.

Table 4. Monthly precipitation variations (inches).

	Jemez Canyon Dam			Wolf Canyon			Jemez Springs			Los Alamos		
Month	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.
Jan.	1.00	3.0	0.0	1.6	4.5	0.20	1.0	3.0	0.0	0.90	2.8	0.10
Feb.	0.90	2.2	0.0	1.5	3.5	0.10	0.9	2.2	0.0	0.70	1.9	0.05
Mar.	1.00	2.5	0.0	1.7	6.3	0.10	1.0	2.5	0.0	1.00	4.1	0.10
Apr.	0.80	2.2	0.0	1.1	3.4	0.00	0.8	2.2	0.0	0.90	3.2	0.02
May	1.00	3.0	0.0	1.2	3.5	0.05	1.0	3.0	0.0	1.10	3.8	0.10
June	0.09	3.3	0.5	1.0	2.4	0.00	0.9	3.3	0.0	1.10	3.4	0.02
July	2.75	4.8	0.5	3.4	6.1	0.80	2.6	4.8	0.0	3.10	6.6	0.30
Aug.	3.10	6.4	0.0	3.5	6.1	0.50	3.1	6.4	0.5	3.90	11.1	1.00
Sep.	1.00	3.5	0.0	1.6	4.2	0.15	1.2	3.4	0.5	1.70	4.5	0.00
Oct.	1.40	6.2	0.0	1.7	5.6	0.00	1.6	6.2	0.0	1.50	6.7	0.00
Nov.	1.00	4.9	0.0	1.5	5.3	0.10	1.0	4.7	0.0	0.90	6.6	0.00
Dec.	0.09	3.2	0.0	1.7	4.0	0.10	0.9	3.2	0.0	0.90	2.8	0.10

During the winter months, heavy snowfall occurs in the upper mountainous areas of the watershed and snow is light over the lower basin. Snow remains in the mountainous areas above elevation 7,000 feet from December into April. Below 7,000 feet in elevation, snow seldom stays on the ground more than a few days. The average annual snowfall varies from 10 inches at Jemez Canyon Dam to over 100 inches in the mountains.

Four notable floods have occurred since the dam was completed in 1953 and the project began operation (Table 6). Summer or fall floods of significant magnitude have not occurred during project operation.

Jemez Canyon Reservoir reached a record pool elevation in 1987. Flood control storage starting on April 13 resulted in a maximum elevation of 5,220.30 feet (72,254 acre-feet) on June 2. The magnitude of storage was attributed to Elephant Butte and Caballo Reservoirs being full. Due to successive years of a full reservoir at Elephant Butte, a tremendous amount of sediment deposition created a plug at the headwaters, which threatened existing levees that protect the Low Flow Conveyance Channel near San Marcial, New Mexico. Additionally, the reduced capacity of the aggraded Rio Grande channel at Fort Quitman, Texas, hampered release of floodwater from Abiquiu, Cochiti, and Jemez Canyon Reservoirs.

Table 5. Annual precipitation variations (inches).

JEMEZ CANYON DAM

Year	Total	Year	Total	Year	Total	Year	Total	Year	Total	Year	Total
1951		1957	7.41	1963	10.26	1969	11.18	1975	13.14	1981	8.07
1952		1958	9.75	1964	6.56	1970	11.60	1976	7.05	1982	12.21
1953		1959	8.29	1965	7.77	1971	8.18	1977	3.80	1983	8.18
1954	7.28	1960	9.36	1966	7.02	1972	9.35	1978	7.27	1984	8.33
1955	6.98	1961	9.46	1967	4.77	1973	12.49	1979	11.93	1985	13.88
1956	2.40	1962	7.43	1968	8.58	1974	7.35	1980	9.20	1986	11.02

JEMEZ SPRINGS

Year	Total	Year	Total	Year	Total	Year	Total	Year	Total	Year	Total
1951	11.28	1957	28.72	1963	13.94	1969	22.93	1975	13.00	1981	13.97
1952	16.20	1958	17.10	1964	13.50	1970	16.61	1976	10.19	1982	20.02
1953	11.72	1959	17.19	1965	20.77	1971	17.15	1977	17.25	1983	16.46
1954	12.31	1960	19.09	1966	11.33	1972	15.80	1978	23.83	1984	13.58
1955	13.61	1961	15.28	1967	15.72	1973	11.27	1979	16.46	1985	25.92
1956	6.17	1962	13.07	1968	14.99	1974	14.50	1980	13.82	1986	22.66

WOLF CANYON

Year	Total	Year	Total	Year	Total	Year	Total	Year	Total	Year	Total
1951	21.00	1957	27.48	1963	17.25	1969	27.08	1975	25.15	1981	24.73
1952	19.00	1958	22.43	1964	21.63	1970	23.10	1976	14.64	1982	25.43
1953	17.03	1959	19.43	1965	26.24	1971	22.67	1977	19.91	1983	27.12
1954	17.67	1960	19.45	1966	21.25	1972	21.58	1978	28.54	1984	23.50
1955	19.29	1961	28.49	1967	20.93	1973	22.76	1979	25.22	1985	27.51
1956	11.24	1962	18.62	1968	18.29	1974	21.12	1980	18.64	1986	30.51

LOS ALAMOS

Year	Total	Year	Total	Year	Total	Year	Total	Year	Total	Year	Total
1951	15.16	1957	28.03	1963	17.83	1969	25.67	1975	19.32	1981	17.07
1952	28.40	1958	16.73	1964	11.26	1970	14.93	1976	13.95	1982	21.49
1953	16.37	1959	21.55	1965	23.70	1971	19.29	1977	16.72	1983	16.53
1954	15.40	1960	18.36	1966	17.48	1972	16.99	1978	20.01	1984	17.36
1955	12.27	1961	20.22	1967	20.80	1973	14.98	1979	15.22	1985	25.50
1956	6.80	1962	15.48	1968	19.55	1974	18.69	1980	11.96	1986	24.12

Table 6. Recent Jemez River floods.

Date	Reservoir elevation (ft, NGVD)	Storage (ac-ft)	Peak inflow (cfs)	Maximum outflow (cfs)	April-June volume (ac-ft)
June 8, 1958	5,213.36	71,220	3,350	4,112	77,440
May 27, 1973	5,189.30	25,830	2,000	2,297	97,710
May 2, 1979	5,186.72	20,460	1,282	1,222	84,190
June2, 1987	5,220.30	72,254	1,242	760	64,383

In the Jemez River Basin, runoff response to precipitation is very rapid due to steep slopes, resulting in floods with very high peak flows. Flood volumes are usually small due to the storm areal extent. The mountain streams are narrow and steep so flow rises very rapidly and falls rapidly after the peak passes. The Rio Salado channel in the lower reaches and the Jemez River channel below the Rio Salado confluence are wide and sandy with a shallow, braided flow pattern that results in rapid attenuation of floods with high peaks and small volumes. The mountains, due to the vegetal cover, have relatively high loss rates of 0.5- to 1.0-inch per hour. This, along with significant depression storage in the valleys, greatly reduces runoff. The mesas have flatter slopes, grass and herbaceous cover, and large playas that reduce runoff. Mesa loss rates vary from 0.2- to 0.5-inch per hour. The area generally below an elevation of 6,000 feet is covered by semi-arid desert vegetation and has the lowest loss rates (0.1- to 0.3-inch per hour) due to the scarcity of vegetation and soils with high clay content. Summer thunderstorms with their very high intensity precipitation and short duration often result in 80% or greater runoff from this area. Spring runoff from snowmelt during March through June produces most of the annual runoff volume.

Plate 4 shows the percentage of annual flow and precipitation by month. Note that 60% of the flow occurs in April and May from the winter snowpack accumulation. The greatest precipitation of 34% occurs as summer thunderstorms in July and August.

The mountain streams are perennial with high flows in the spring or immediately following a storm. Summer, fall, and winter flows are very low and clear. The Jemez River is usually dry during the summer below the Rio Salado confluence due to irrigation diversions and evapo-transpiration. Most streams below 7,000 feet in elevation are intermittent and flow only following precipitation that exceeds infiltration and evapo-transpiration losses. Inflow and outflow discharge frequency curves are shown on Plate 5 (USACE 1994).

3.05 GEOMORPHOLOGY

The Jemez River originates in the Jemez Mountains and flows southeasterly for about 65 miles. It is perennial in the upper reach and ephemeral in the lower reach due to percolation and irrigation diversions. The total area drained by the river is 1,038 square miles, with 1,034 square miles above the dam. The watershed is about 65 miles long with a maximum width of 30 miles. The terrain rises from elevation 5,120 feet at the dam to over 11,000 feet in the mountainous region of the headwaters. The stream channel in the upper reach is confined within narrow canyons. The stream meanders through a broad sandy valley in the lower reaches and through the reservoir area which is several hundred feet wide without well-defined banks. Below the dam the river enters a narrow canyon, which extends to the confluence with the Rio Grande. Stream slopes vary from 18 feet per mile at the dam to more than 250 feet per mile in the mountains. The Jemez River and tributary thalweg profiles are shown on Plate 6.

The principal mountain tributary is the Rio Guadalupe, which enters the Jemez River about 26 miles upstream from the dam. It rises in the Jemez Mountains and is perennial. Coniferous forest, interspersed with groves of aspen, covers the watershed above 7,000 feet. Vegetal cover in the lower elevations includes pinyon pine, juniper, and oak brush with very sparse grasses and herbs. The upper area is characterized by steep slopes varying from 250 feet per mile to 130 feet per mile, which results in rapid runoff.

The principal tributary in the lower basin is the Rio Salado, an ephemeral stream, which drains the southwest portion of the Jemez River Basin. It originates in the lower mountain region and flows through the highly erodible, low-lying plateau area of the watershed. Vegetal cover is sparse and consists of short

grass and desert shrubs. Slopes in this area vary from about 130 feet per mile at higher elevations to 18 feet per mile in the vicinity of the dam. Because of the nature of the soils and plant cover, the lower area is much more conducive to runoff than the upper area. The Rio Salado-Jemez River confluence is near San Ysidro about 17 miles upstream from the dam.

The Jemez River from the confluence with the Rio Salado downstream to the reservoir is a broad sandy channel with a very shallow braided flow pattern. The Rio Salado channel is very similar to the Jemez River channel for the lower one third of its length. The higher stream channels of both the Jemez River and Rio Guadalupe are steep, narrow and well armored. Jemez River thalweg profiles are shown on Plate 6.

Jemez Canyon Dam is located at the head of a deep narrow canyon about 2.8 miles above the confluence with the Rio Grande. Channel capacity is greater than that required for controlled releases. Prior to establishing the 2,000 acre-foot sediment pool, the stream below the dam had a sandy bed with a broad fan at the Rio Grande. Since then, flow has degraded the streambed and it is now a rock-armored channel similar to high mountain streams. A single channel has been cut across the fan to the Rio Grande and the bar that was in the Rio Grande channel gradually disappeared.

3.06 SEDIMENTATION

The Jemez River above its confluence with the Rio Salado at San Ysidro has a drainage area of about 600 square miles. From sediment sampling records between February 1937 and June 1941, suspended sediment passing San Ysidro was approximately 400 acre-feet per year and the average concentration for all months of record was 0.46% sediment by weight. Some sediment was diverted into irrigation ditches at San Ysidro. No sediment samples have been secured from this location since 1941.

The Rio Salado has a drainage area of about 251 square miles, most of which is plateau with rough, broken and hilly terrain, and is easily eroded. For about three miles above San Ysidro, the streambed is wide and sandy. Sediment sampling on this stream showed that the sediment carried was about 150 acre-feet per year including 15 acre-feet of bed load. Records of sediment sampling from the Jemez River at Zia Pueblo, about five miles below the Jemez-Rio Salado confluence, show an average annual suspended sediment load of about 500 acre-feet per year.

Below San Ysidro, the characteristics of Jemez River suddenly change. The slope becomes flatter and the streambed becomes wider and is plugged with sand and fine material, which is washed into the river from tributaries and aeolian deposition. The 183 square miles of drainage area between Jemez Dam and San Ysidro produces about one-half of the total sediment entering the reservoir area. Most of the sediment comes from the south side of the Jemez River where the Santa Fe formation is exposed or is covered with a mantle of wind-blown alluvium. The area is sparsely vegetated. The terrain consists of rolling hills cut by numerous steep-sided arroyos. Near the river the dunes are extensive and have advanced to the edge of the stream. Runoff from this area discharges large quantities of sediment into the river. The suspended sediment load entering the reservoir area was estimated to be about 910 acre-feet per year and the bed load about 10% of the suspended load for a total of about 1,000 acre-feet per year. (See Table 7 for history of sediment surveys.) Approximately 60% of the total yearly runoff occurs during the spring runoff period and about 70% of the total suspended sediment load occurs during this period (USACE 1994)

Table 7. Summary of reservoir sediment surveys.

Survey date	Period (years)	Volume deposited (ac-ft)	Rate for period (ac-ft/yr)	Estimated trap efficiency (%)	Remaining sediment space (ac-ft)
Oct 1953		Began Operation			44,213
Aug 1959	5.92	3,339	564	65	40,874
Dec 1965	6.33	1,065	168	42	39,809
Jan 1975	9.08	6,709	739	68	33,100
Dec 1983	8.92	3,388	380	83	29,712
Jun 1991	7.50	2,227	296	90	27,483
Jun 1998	7.00	3,060	437	92	24,425

The transport and deposition of sediment, which affects the operation of Jemez Canyon Reservoir, are monitored by the measurement of suspended sediment concentrations of reservoir outflow and by periodic ground and hydrographic surveys of the reservoir area. The following survey data were used in analyses for this Environmental Assessment:

(1) Suspended Sediment Sampling -- Samples below the dam were collected for approximately 45 years and discontinued in 1993. Approximately once per year, suspended sediment samples were shipped from the project office to the Southwestern Division Laboratory for analysis of suspended sediment concentrations and grain size gradation determination.

(2) Reservoir Sedimentation Ranges -- Thirteen transverse sediment ranges were installed in Jemez Canyon Reservoir in 1952 and marked with concrete monuments. Each range was numbered and profiled. Ranges 10 through 13 are located above the maximum water surface of the reservoir for the purpose of determining channel changes and aggradation or degradation of the river channel. Ranges 1 through 9 are used to determine the amount of sediment deposition that has taken place in the reservoir area. Reservoir sedimentation and degradation ranges are shown on Plate 7. Sedimentation resurveys are normally scheduled on a 5- to 7-year basis. Resurveys at Jemez Canyon Reservoir were made in August 1959, December 1965, January 1975, December 1983, June 1991, and June 1998.

(3) Degradation Ranges -- There are 14 degradation ranges located across the Jemez River below the dam (Plates 8 - 10). The end points of the degradation ranges are marked with permanent survey monuments. Degradation rangeline resurveys were made in August 1959, December 1965, January 1975, December 1983, June 1991, and August 1998. (USACE 1994)

A review of the periodic estimated trap efficiencies from the reservoir sediment surveys strongly indicates that the presence of a sediment pool has a dramatic effect on sediment retention. Prior to the initial 2,000 acre-foot sediment pool in 1979, estimated trap efficiencies averaged 59% and ranged from a low of 42% to a high of 68% through January 1975. The following survey in December 1983 produced an estimated trap efficiency of 83% for the roughly 9-year period, during about half of which there was no pool. The next reservoir survey in June 1991 captured a 7.5-year period during which there was always a pool, and resulted in an estimated trap efficiency of 90% (USACE 1994).

An attempt was made to mathematically separate the January 1975 to December 1983 period for pre- and post-pool portions by time-weighting. Setting the 1975-to-1979 period value at 68% (the highest value from the pre-pool periods) resulted in a post-pool efficiency value of 97%, higher than the 90% 1983-to-1991 post-pool period. Setting the pre-pool value below 65% produced a post-pool value exceeding 100%. Assuming a 1979-to-1983 (post-pool) value of 90% produced a 1975-to-1979 (pre-pool) value of 76%. This simple analysis ignored the variability of the periodic hydrology; however, it indicates that a sediment pool of at least 2,000 acre-feet substantially increases the trap efficiency of the reservoir.

The longitudinal reservoir profile diagram was updated to include the June 1998 sedimentation rangelines survey. Plate 11 shows the original channel profile of 1952, the 1975 survey and the 1998 survey. The apparent extent of upstream influence of sediment deposition on the channel is around Range R-9, just upstream of the bridge to the old Santa Ana Pueblo. There is reason to believe that this bridge causes deposition to be greater in this immediate area, but it is affected by the reservoir (USACE 1975). The 1998 survey shows increased depositional depth at Range R-4. The elevation of deposition corresponds rather well to the mean pool elevation since 1986, indicating another localized area of greater deposition and its cause.

The outlet works and channel downstream from the dam also have exhibited a response to sediment retention with the pool. Prior to the sediment pool, the stilling basin was typically full of sand; now it remains filled with relatively clear water (USACE 1994). Following the survey of the degradation lines downstream from the dam in January 1975, the average rate of degradation since September 1953 (22.41 yrs.) for the 2.56 miles was 0.91 acre-foot per year (USACE 1975). A survey of the degradation lines in August 1998 was used to update this rate, which showed an average annual degradation of 12.18 acre-feet per year for the 45.92-year period the dam has been in place.

It should be noted that the post-1975 period corresponds roughly with closure of Cochiti Dam upstream on the Rio Grande. Present water management in the middle Rio Grande valley includes numerous flood and sediment control dams and reservoirs, irrigation storage reservoirs, levees, channel maintenance, irrigation diversions, drainage systems, and runoff conveyance systems. In addition, the river has been stabilized in its present location in the floodplain by the installation of jetty jacks in the 1950s and 1960s. River sediment loads and debris settled in the jacks, creating stable banks and a riparian zone dominated by trees and shrubs. All these activities affect channel morphology through alterations in discharge and sediment load. Sediment retention at Cochiti Dam and, to a lesser extent, other upstream facilities, has resulted in significant changes in the Rio Grande channel from Cochiti Dam to downstream from the entry of the Jemez River. Near this confluence, vertical lowering of the mainstem Rio Grande is on the order of 12 feet. This has resulted in a lowering of the bed level at the confluence and induced incision in the Jemez River below Jemez Canyon Dam. Typically, stream reaches below a dam exhibit degradation as they attempt to reestablish an equilibrium condition (Simons and Senturk 1977). This decreases the stream gradient, since the amount of degradation decreases as the distance from the dam increases. However, lowering of the bed level at the Rio Grande increases the Jemez slope and has added to the degradation and armoring of the Jemez River.

Prior to establishment of a sediment pool, the Jemez River channel downstream to the Rio Grande was described as having a sandy bed that terminated in a large delta at the confluence. The bed has since coarsened to predominantly gravel and cobble and has armored (USACE 1994). The Pueblo of Santa Ana recently classified the geomorphological characteristics of this reach using the Rosgen Classification System (Rosgen 1996). Approximately 2.5 miles of the Jemez River channel was broken into six reaches, with 3 riffles within each reach surveyed and classified. Channel types found were “B,” “C” and “F”

channels, with dominant substrates in the gravel and cobble range. Of the three types, the "B" channel is considered to be the most stable, and this type comprised 67% of the reach evaluated. The "C" and "F" types accounted for 11% and 22%, respectively. Examination of the 1959, 1965, 1975, and 1998 degradation line surveys indicated that the channel has undergone an average of 13.5 feet of degradation and an average of 9.7 feet of lateral thalweg movement (pers. comm., James Zokan, Watershed/Rangeland Program Manager, Pueblo of Santa Ana Dept. of Natural Resources, August 2000).

3.07 GROUNDWATER

Groundwater at the reservoir has increased due to bank storage within the Santa Fe formation and the quaternary sediments within the reservoir area. The sand and gravel allow bank storage to equilibrate to the pool elevation relatively quickly.

During construction of the Santa Ana Pueblo levee, pumps were installed remove water from the interior of the levee. Since the establishment of the 1986 sediment pool it has been necessary to pump water from the site weekly. During spring runoff season, it has been necessary to pump twice weekly. Four piezometers were installed at the site in May 2000. Although there is limited data to this point, it appears the groundwater is mostly influenced by the existing stream flow.

3.08 WATER QUALITY

The water within the Jemez Canyon Reservoir sediment pool is slightly alkaline with a surface pH of around 7.7 and dissolved oxygen at the surface is greater than 6 mg/l. Turbidity of the pool is high during periods of high inflow rates; however, outflow turbidity is much reduced due to settlement of sediment within the pool itself. Outflow is largely clear during periods of low inflow.

The New Mexico Water Quality Control Commission (NMWQCC 1995) describes the designated uses for the ephemeral reaches of the lower Jemez River as irrigation, limited warmwater fishery, livestock watering, and secondary recreational contact. Designated uses of the Rio Grande from Angostura Diversion downstream to the Alameda Bridge in Albuquerque are the same, with wildlife watering being an additional use.

In the spring of 1999, the Pueblo of Santa Ana, the New Mexico Fisheries Resource Office of the U.S. Fish and Wildlife Service, and the Corps cooperated in a preliminary study of heavy metal concentrations in the reservoir, sediments, and biota at Jemez Canyon Reservoir. Surficial sediment samples showed no contamination of metals, and one water sample was just above the detection limit for mercury. (See additional discussion below regarding biota.)

The following paragraphs summarize pertinent responsibilities of federal, state, and tribal agencies in the general project area.

Section 404 of the Clean Water Act provides for the protection of "waters of the United States" from impacts associated with irresponsible or unregulated discharges of dredged or fill material in aquatic habitats, including wetlands as defined under Section 404(b)(1).

Section 401 of the Clean Water Act requires that a Water Quality Certification Permit be obtained for anticipated discharges associated with construction activities or other disturbance within waterways.

For activities on lands within the Pueblo of Santa Ana (that is, the entire Jemez Canyon Reservoir, the Jemez River below the dam, and the Rio Grande downstream nearly to the Highway 44 bridge) permitting is the responsibility of the U.S. Environmental Protection Agency. For activities affecting the Rio Grande below the Highway 44 bridge, Section 401 permitting is the responsibility of the New Mexico Environment Department, or Sandia Pueblo for the reach within their tribal boundaries.

Section 402(p) of the Clean Water Act specifies that storm water discharges from construction sites must be authorized under the National Pollution Discharge Elimination System. Construction sites are defined as areas of clearing, grading, and excavation activities that disturb five or more acres of land. Prior to the start of construction, a Storm Water Pollution Prevention Plan must be prepared by the Government or the construction contractor and a Notice of Intent would be filed with Region 6 of the Environmental Protection Agency.

3.09 AIR QUALITY AND NOISE

Sandoval County is within the State of New Mexico's Air Quality Control Region 2 (EPA Region 152) (NMED 1997). The County is in attainment status for National Air Quality Standards for priority pollutants (particulate matter, sulfur oxides, nitrogen dioxide, carbon monoxide, ozone, and lead), meaning that ambient air quality meets or exceeds State and Federal standards. Generally, the only air pollutant of concern in the area is particulate matter (blowing dust during periods of high winds). In the State's Prevention of Significant Deterioration program administered by the New Mexico Environment Department, the region is designated Class II, which allows for moderate development and its associated air emissions. The nearest Mandatory Class I area to Jemez Canyon Reservoir is the Bandelier Wilderness Area, approximately 25 miles to the north.

Existing noise levels in the Jemez Canyon Reservoir area are very low, as is typical of rural locations. The major source of ambient noise is air traffic to and from local airports.

3.10 ECOLOGICAL SETTING

Plant Communities

Jemez Canyon Reservoir is within the Plains-Mesa Sand Scrub biotic community as defined by Dick-Peddie (1993), and vegetation typical of this community dominates the entire area south of the reservoir. The following grasses and forbs occur in sparse to moderately dense stands throughout the area: black grama, New Mexico feathergrass, western wheatgrass, galleta, sand dropseed, and ring muhly. Shrubs commonly found throughout the area include four-wing saltbush, sand sagebrush, rabbitbrush, bush penstemon, and, occasionally, one-seed juniper. Unconsolidated sand dunes with sparse pioneer vegetation occur in a portion of this community. At slightly higher elevations, and often interspersed with the sand scrub community, are pinyon pine / one-seed juniper woodlands.

Prior to construction of Jemez Canyon Dam in the early 1950s, the Jemez River floodplain between the damsite and the old Santa Ana Pueblo was very sparsely vegetated (USACE 1976). The river occupied a wide, braided channel through the area. Plant community establishment was likely hindered by ephemeral flows, periodic large floods and deposition of sediment, and a shifting channel location. Riparian vegetation likely bordered at least a portion of the channel, especially near the western end of the current reservoir, but information on its location and extent are lacking.

By the early 1970s, vegetation occupied about 624 acres of the 1,143-acre space below elevation 5,197 feet (USACE 1976). Vegetation development was likely enhanced by more frequent (but still periodic) flooding due to flood control operation which generally increased soil moisture and nutrient availability. The widespread invasion of salt cedar throughout the middle Rio Grande Valley during this period also contributed to plant community development at Jemez Canyon Reservoir.

In 1976, the portion of the reservoir immediately adjacent to the dam was unvegetated due to a high concentration of clay and fines which inhibited plant establishment. The lower third of the reservoir area was almost exclusively salt cedar with little or no understory (USACE 1976). The upper portion of the reservoir was vegetated by sparse salt cedar with a modest understory of salt grass and sedges. A salty crust on the soil surface was common. Areas in the central portion of the reservoir which were slightly elevated due to sediment deposition were vegetated by galleta, sand dropseed, and scurf-pea, and were transitional communities between the salt cedar stands and the dry grassland/sagebrush community to the north and south.

A dense and varied riparian community bordered the river channel which wound through the reservoir (USACE 1976). Mixed stands of willow, cottonwood, Russian olive, and salt cedar were interspersed with western wheatgrass, mat muhly, ring muhly, and shadscale. The relatively moist soils along the river channel were able to sustain willow and cottonwood growth, while salt cedar dominated the drier soils throughout the remainder of the basin. Tree ages indicated that flood control storage during 1959 and 1965 was responsible for germination of most of the woody vegetation throughout the reservoir.

Vegetation patterns were not markedly different in 1984. The establishment of the 2,000-acre sediment pool in 1979 inundated up to 100 acres of dense salt cedar in the lower portion of the reservoir (USACE 1984). Plant communities in the upstream portion of the reservoir appear to have been affected only locally where sediment deposition patterns were altered as a result of the pool.

Currently, riparian vegetation occurs at the reservoir delta and along the Jemez River below the dam. A narrow band of riparian vegetation occurs along the sediment pool margins. In the delta area, large mixed stands of Rio Grande cottonwood, Gooding's willow, and coyote willow occur, intermixed with non-native Russian olive and salt cedar. Approximately 230 acres within the 2-mile-long delta reach consists of fairly dense tree- or shrub-dominated stands, and another 75 acres consists of sparse salt cedar. Along the reservoir shoreline and the river below the dam, woody vegetation is more sparsely, linearly distributed. Alkali sacaton and saltgrass are common grass species in these riparian communities

Wetlands

Although formal delineation surveys have not been conducted as yet, the majority of the 300-acre vegetated delta discussed above would likely be classified at wetland as defined in Section 404(b)(1) of the Clean Water Act. The area is dominated by facultative and facultative-wetland species and is inundated by surface flows for at least 11 contiguous days during the growing season. (A formal wetland determination would be conducted in the area during October or November 2000.) The Jemez River channel and the current sediment pool are regulated "waters of the United States" as defined in Section 404.

Fish

No comprehensive fish surveys have been conducted at Jemez Canyon Reservoir. Fish species known to be present include largemouth bass, white bass, channel catfish, common carp, sunfish, crappie, white sucker, gizzard shad, and small numbers of brown and rainbow trout. Prior to the creation of the current sediment pool, the fish community was comprised primarily of native species (along with white sucker) adapted to the ephemeral condition of the lower Jemez River.

In the spring of 1999, the Pueblo of Santa Ana, the New Mexico Fisheries Resource Office of the U.S. Fish and Wildlife Service, and the Corps cooperated in a preliminary study of heavy metal concentrations in the reservoir, sediments, and biota at Jemez Canyon Reservoir. Tissue samples of largemouth bass and channel catfish indicated some bioaccumulation of mercury. Mercury concentrations in several samples were greater than 0.5 parts per million (ppm) wet weight, indicating a low level of risk for consumption. Preliminary comparison to the U.S. Environmental Protection Agency (1977) "reference doses" suggest that there could be a risk to young children and pregnant women consuming fish for as few as 14 days per year.

Sand scrub/grassland vegetation has a naturally low carrying capacity for wildlife. Although similarly limited, the scree slopes and steep sides of the mesas to the east and north of the reservoir provide escape cover and protection to wildlife the area. Common wildlife species likely to utilize upland areas around the reservoir include Scaled and Gambel's Quail, Mourning Dove, coyote, badger, cottontail rabbit, jackrabbit, ground squirrel, various songbirds, hawks and, occasionally, mule deer and elk. Riparian habitat is used at least sporadically by virtually all of these species.

The sediment pool provides habitat to resident and migrating waterfowl such as Canada Goose, Mallard, Northern Pintail, Blue-winged and Green-winged Teal, Northern Shoveler, and American Coot. Sandhill Cranes regularly roost at the reservoir during winter. Waterbirds likely occurring in the area include Great Blue Heron, Spotted Sandpiper, Killdeer, and, during migration, American Avocet, Short-tailed Dowitcher, and Lesser Yellowlegs. Northern Harrier and Osprey have occasionally been observed in the reservoir area. Several nests of Double-crested Comorant occupy inundated, dead trees at the western end of the reservoir.

Threatened and Endangered Species

The Rio Grande silvery minnow (Federal endangered) is known to occupy the Rio Grande and the Jemez River downstream from Jemez Canyon Dam. Surveys conducted by the Pueblo of Santa Ana and the New Mexico Fishery Resource Office along the lower Jemez River in May 2000, netted 21 adult silvery minnows. A portion of this reach immediately downstream from the dam has flood-prone benches which may provide suitable slackwater refugia for minnows during high discharges. The lower portion of the reach is incised and lacks slackwater areas. Silvery minnows likely are present in the lower Jemez River opportunistically during relatively low-flow periods; higher discharges would move the fish downstream to the Rio Grande. Only a single silvery minnow has been captured during monthly surveys between February and August 2000 in the Rio Grande between Angostura Diversion and the Highway 44 bridge (survey data from the Bureau of Reclamation, the U.S. Fish and Wildlife, and the University of New Mexico). However, as many 22 individuals were encountered during surveys of the reach from the Highway 44 bridge downstream to the Corrales siphon.

Approximately 90% of the remaining silvery minnow population is found in the Rio Grande downstream from the San Acacia Diversion Dam. The potential for threateningly low flows, and the need for supplemental flow, in that reach of the Rio Grande during 2000 is, in fact, the reason the proposed action has been instigated. Critical habitat for the Rio Grande silvery minnow has been designated along the Rio Grande from the Highway 22 bridge immediately below Cochiti Dam downstream for approximately 160 miles to the San Marcial railroad bridge in Socorro County (64 FR 36274-36290; July 6, 1999).

The Southwestern Willow Flycatcher (Federal endangered) may occur in a variety of riparian habitat types along the Rio Grande and Jemez River during spring or fall migration periods. Vegetation suitable for use during migration occurs at the margins of the Jemez Canyon Reservoir, throughout the delta, and along the Jemez River downstream from the Dam.

Breeding habitat for Southwestern Willow Flycatchers includes very dense, tall shrubs with a partial overstory situated in or adjacent to saturated soils or water bodies. Potentially suitable flycatcher breeding habitat occurs in the delta at the western end of the Jemez Canyon Reservoir (pers. comm., Todd Caplan, Director, Pueblo of Santa Ana Department of Natural Resources, August 2000). The nearest known breeding flycatchers occur along the Rio Grande near San Juan Pueblo and Isleta Pueblo, 50 miles upstream and 35 miles downstream, respectively, from the confluence of the Jemez River.

Bald Eagles (Federal threatened) are known to be present along the Rio Grande and at Jemez Canyon Reservoir during the winter. Both adult and juvenile birds may be present in the area between late November and early March.

The Corps conducted aerial surveys for Bald Eagles between 1988 and 1996 during January, the month of highest abundance. During the 8 years of survey, Bald Eagles were present at Jemez Canyon Reservoir during 4 years and the number of birds observed ranged from 0 to 3. The same frequency and maximum number of eagles were observed along the mainstem of the Rio Grande from the confluence of the Jemez River downstream to the Interstate 40 bridge at Albuquerque during the same survey period. The number of Bald Eagles observed along the Rio Grande from the Jemez River confluence north to and including Cochiti Lake was significantly higher (Table 8). While data from these areas are not exactly comparable because of the differing length of river channel or lake shoreline, they do indicate that Bald Eagles are not utilizing Jemez Canyon Reservoir preferentially.

Table 8. Bald Eagle occurrence along the Rio Grande and major reservoirs during aerial surveys in January, 1988 to 1996, conducted by the Corps of Engineers.

Reach or reservoir	Number of years present	Mean (SD)	Min.	Max.
Rio Grande: I-40 Bridge (Albuq.) to Jemez River confluence	4	0.8 (1.0)	0	4
Jemez Canyon Reservoir	4	0.9 (1.1)	0	3
Rio Grande: Jemez River confluence to Cochiti Dam	8	12.6 (6.2)	3	23
Cochiti Lake	6	3.7 (5.8)	0	18

3.11 LAND USE, RECREATION, AND AESTHETICS

All lands associated with the Jemez Canyon Dam and Reservoir Project are held in trust by the United States for the benefit and use of the Pueblo of Santa Ana. The Department of the Army and the Pueblo of Santa Ana signed an MOU in 1952 (augmented in 1978 by P.L. 95-498) which established a perpetual right and privilege for the construction, operation, and maintenance of the Jemez Canyon Dam and Reservoir Project. The Pueblo of Santa Ana reserved the right to use all associated lands for any purposes not inconsistent with those expressly granted to the government for the facility.

The current sediment pool is not open to public access. Tribal members have utilized the pool for recreational and fishing purposes; however, access has been restricted from use by tribal members pending further investigation of the contaminant levels in fish. Areas within the entire flood control space are utilized for several purposes, including moderate cattle grazing (approximately 200 head).

The public use area at Jemez Canyon Dam is limited to 10 acres atop the outcrop immediately south of the dam. The day-use area consists of 6 picnic shelters, a parking lot with 12 automobile spaces, garbage containers, a vault toilet, 3 water hydrants, a bulletin board. Area lighting is provided by the Public Service Company of New Mexico. Because of the limited facilities, public visitation is low when compared to other attractions in the area. During fiscal year 1999, 19,324 visitor-hours were estimated at Jemez Canyon Dam, compared to 1,132,103 visitor-hours at nearby Cochiti Lake.

Principal visual attractions from the public use area include the dam, the basalt slopes and outcrops of Santa Ana Mesa, Jemez River Canyon downstream from the dam, and nearly all of the roughly 1,200-acre sediment pool.

3.12 CULTURAL RESOURCES

The Jemez Canyon Dam is within the archaeological area defined by Wendorf and Reed as the Northern Rio Grande Region (Rodgers, 1979:16). The approximately 12,000 years of cultural interaction in this area can be subdivided into three broadly defined periods based on constellations of artifacts recovered archaeologically. Given the ecological nature of the surrounding region, the remains associated with rather short-term resource exploitation by hunter-gatherers represent the first 10,000 years. The earliest sites date between approximately 10,000 B.C. and 5,500 B.C. and represent the Paleo-Indian big-game hunters. Clovis Points (10,000 B.C. to 9,000 B.C.), generally associated with mammoth, and Folsom Points (9,000 B.C. to 8,000 B.C.) associated with the extinct *Bison antiquus* are found in isolation and at small sites. Other extinct game animals include camel and horse. Most Paleo-Indian sites in the greater Albuquerque area have been recorded during survey, although some excavation occurred prior to housing construction at Rio Rancho. The range of site types identified includes tool manufacturing, resource processing related to hunting, and base camps occupied for longer periods of time. Many of these sites are on high ground with unobstructed views (Rodgers 1979:16-17). Other Paleo-Indian Point types that have been recognized in the Southwest and New Mexico include Hell Gap, Midland, Plainview, Milnesand, Meserve, and Scottsbluff. Diagnostic Paleo-Indian spear points are lanceolate-shaped with flutes removed from both sides; other tools that have been recovered include scrapers, knives, perforators, and informally utilized flakes. While plant gathering and processing occurred, the artifacts associated with these activities have not been generally recognized.

The Archaic Period extends from approximately 5,500 B.C. to A.D. 400 and represents a continuation of the hunting-gathering adaptation. By this time the population of animals is similar to those

found today and this represents the primary difference from the preceding Paleo-Indian Period. Both large and small animals were hunted and trapped. Based on the increasing presence of manos and metates, it is clear that the processing of plants becomes more important. Towards the end of the Archaic, longer-term habitation sites that include shallow pit houses are found in areas of the Southwest including central New Mexico. Limited activity Archaic Period sites without diagnostic projectile points, especially those exposed on the surface, can be difficult to identify and are recorded as temporally unknown sites. The undiagnostic lithic scatter is the most commonly recorded site in the Laboratory of Anthropology data base.

Along the Rio Grande within northern and central New Mexico, the Archaic–Period inhabitants are referred to as the Oshara Tradition. This Period is subdivided into six phases based on differing diagnostic projectile points, although two major changes occurred towards the end of the Archaic. Indications of maize appear in the archaeological record by about 2000 B.C.; however, it becomes relatively more common after 1000 B.C. Finally the bow and arrow appears about A.D. 500 and replaces the spear as the primary weapon (Rodgers 1979:16-18; Bayer 1994: 250-252).

The Archaic Period is succeeded by the Anasazi or Pueblo Period. Depending on the location in northern New Mexico, between three and five major phases are recognized and are based on a host of characteristics, including house forms and construction techniques, settlement patterns, pottery types, and other elements of material culture. While hunting and gathering continued, reliance on agricultural products continually increased. Pit house villages with larger communal structures indicate larger social groups living in one location for longer periods of time. Initially small surface living and storage rooms with below ground communal and religious structures supplant and generally replace the pit house villages. As populations increased, these small houses were replaced with large buildings of up to several hundred rooms made of rock and or adobe. Not all of the rooms were necessarily occupied at once.

The Developmental Period dates between A.D. 600 and 1200 and can be subdivided into Early and Late depending on the predominance of pit house or above ground architecture. Early in the period the associated ceramics are similar to those found throughout the Pueblo area; later in time the stylistic attributes, including paint, design, and temper, become more locally diagnostic. The Coalition Period, A.D. 1200 to 1325 marks a more intensive use of the Pajarito Plateau; a change from mineral- to carbon-paint pottery; and as suggested by the number, size, and distribution of larger permanent habitation and seasonally-specific special-use sites, a marked increase in the population. The Classic Period, A.D. 1325 to 1600, spans the time of the widest settlement distribution, the largest sites, and the earliest Spanish contact beginning with the Coronado Expedition in 1540. After several expeditions by others, the first permanent Spanish occupation in New Mexico began in 1598 near the present location of San Juan Pueblo. Glaze-painted pottery is introduced for the first time. Increasingly sever and wide spread droughts and impacts from the European colonizers disrupted the native population. There was a gradual retrenchment into an aggregated settlement pattern (Rodgers 1979:18-22; Bayer 1994:252-255).

The Historic Period is characterized by rapid change and acculturation between the Indians, Spanish, Mexicans, and Americans. The Period dating from about A.D. 1540 to the present can be divided into seven phases reflecting aspects of social interaction, such as Spanish Exploration, followed by Colonization, the Pueblo Revolt, Spanish and Mexican Colonial, United States Territorial, and Statehood.

Currently, there are four major linguistic groups among the Pueblo Indians of the Southwest: Zuni, Hopi (Uto-Aztecan), Tanoan, and Keres. There are seven major dialects of Keres, including the western groups of Acoma and Laguna; and the eastern groups of Santo Domingo, San Felipe, Cochiti, Zia, and

Santa Ana. The latter two dialects are sufficiently close to suggest a separation of less than 600 years. There is general agreement that the recent ancestral homeland of Santa Ana, that is after A.D. 1300, included, among others, locations in the Pajarito-Frijoles River areas, locations adjacent to the Rio Grande, the Galisteo Basin and perhaps Paa-ko. However, there is less agreement concerning their ancestor's location prior to A.D. 1300. Based on a variety of materials recovered archaeologically, including ceramics, many scholars believe that their ancestors originated from the general area around Mesa Verde and the Four Corners of New Mexico, Colorado, Arizona, and Utah. This agrees with the Santa Ana and Keres legends of moving to the south (Akins 1993:139-144; and Bayer 1994:247-266).

No archaeological work occurred at the time of the 1950 to 1953 Jemez Dam construction; however, two archaeological surveys were conducted in conjunction with later undertakings at the dam. The first, a survey was conducted in 1977. The survey included a 200-foot wide road right-of-way of an entrance road to the dam from Highway 44, the realignment of the old haul road into the canyon, and a 10-acre overlook recreation area. A total of 10 limited activity sites were discovered. These included one prehistoric ceramic and lithic scatter from the Classic Period; four undiagnostic lithic scatters; one field house with no associated artifacts; two small habitation structures with associated corrals; and two religious sites (Ward 1977).

The second archaeological investigation, a survey of 1,200 acres in the flood pool, occurred in 1979 in conjunction with the establishment of a permanent 2,000 acre-foot sediment pool. A total of 18 archaeological sites and 17 locations of isolated artifacts were recorded. Seven prehistoric sites; six early historic sites, dating after A.D. 1550; and five sites from the recent historic, after A.D. 1700, were recorded. The kinds of sites recorded include petroglyphs, lithic scatters, habitation, agricultural, and ranching.

No excavations were conducted. During the survey, a small number of sherds and lithics were collected in order to accurately determine their typological categories. These artifacts were returned to the Pueblo in 1980 (Rodgers 1980).

Traditional cultural properties do occur within and adjacent to flood control space of the Jemez Canyon Dam and Reservoir project.

3.13 SOCIO-ECONOMIC ENVIRONMENT

The Pueblo of Santa Ana Reservation covers approximately 79,000 acres spanning the Rio Grande and lower Jemez River. The majority of the population of approximately 650 resides near Los Ranchitos along the east side of the Rio Grande. The primarily ceremonial old pueblo mentioned previously in this document is located at the west end of Jemez Canyon Reservoir.

Principal employment sectors include agriculture and service. Over the past 25 years, the Pueblo of Santa Ana has developed a successful agricultural enterprise centered on the production and processing of organic blue corn products. Other natural resource enterprises include sand and gravel mining and a native plant nursery. Extensive recreational and entertainment attractions include the Santa Ana Star Casino, the Prairie Star Restaurant, a 27-hole golf course, and a 22-field soccer complex. The Tamaya Hyatt resort is planned to open in December 2000.

4. POTENTIAL EFFECTS OF THE PROPOSED PLAN AND NO-ACTION ALTERNATIVE

4.01 EFFECTS OF THE PROPOSED PLAN

Sedimentation

As discussed in Section 3.06, a sediment pool of diminished size would still function with moderately high trap efficiency. The reduced sediment pool which would be present between October 2000 and August 2001 would still function to remove a large portion of the suspended sediment near the upstream edge of the pool.

Geomorphology and Hydrology

After the current sediment pool is drawn down by 14 feet (12,000 acre-feet), a definitive channel would develop in the deposition delta by subsequent inflow. This channel would be unstable from lack of vegetal stabilization, and headcutting would likely initiate near the upstream boundary of the pool. The ultimate channel slope would not exceed the pre-dam gradient since the remnant pool vertically limits an increase; however, the stream could incise as much as 14 feet from its present elevation. A deep, narrow initial channel shape in this area would be expected, though it could become wider and shallower rather quickly without stabilizing vegetation.

Potential degradation would be minimized by constructing a new channel through the deposited material and installing a grade control at its downstream end (near the upstream edge of the remnant pool). Based on hydrologic parameters of the Jemez River, the proposed channel is envisioned to be 3.3-miles long with a 40-foot-wide bottom and have low sinuosity (about 1.1). Bank stabilization would be included as needed and a sheet pile grade control structure would be installed at the lower end to arrest potential headcutting which could originate downstream as the remnant pool further recedes. A potential alignment of the proposed channel would be along the southern edge of the current pool to provide some localized wetting of the existing riparian vegetation in the upper reservoir area. The proposed channel would terminate at a channel remnant that exists beneath the current pool near the center of the reservoir.

Final design of the channel would be accomplished in October through December, 2000, and excavation would be performed during January through March, 2001. It is imperative that this work be completed prior to the spring snowmelt runoff season to prevent severe headcutting. During construction, a staging area of approximately one acre would be required. The staging area and any other upland areas disturbed by construction activities would be revegetated with native plant species.

During the release of 12,000 acre-feet, erosion within the Jemez River channel downstream from the dam is not expected to be significant. Hydraulic numerical modeling of the 1998 degradation rangelines shows some potential to move the armor layer in the downstream channel in some areas. However, the probability of this seems low, given the average substrate sizes reported by Zokan. Though some vertical change is expected, erodible material has become more available in the channel banks. A potential peak discharge rate of up to 600 cfs during the release of 12,000 acre-feet is well within the historic operational outflows and is, therefore, presumed to have an insignificant impact on the channel. Additionally, discharges up to 600 cfs would not exceed the channel capacity, nor the average estimated bankfull discharges, calculated from the Pueblo of Santa Ana geomorphological data.

Geology and Groundwater Hydrology

There are no aspects of the proposed plan that would affect the geological characteristics of the area. No impact is anticipated upon fault zones in the vicinity of the reservoir due to the relatively rapid evacuation of 12,000 acre-feet. There has been no seismic activity centered near the dam or reservoir since completion of the project. Substrate stability at the foot of the dam and outlet works would not be adversely affected.

The water table in the immediate vicinity of the pool would be lowered as a result of the 14-foot drawdown of the pool surface. Bank storage due to the years of impoundment would be released over several years.

The proposed drawdown would alleviate, but not eliminate, high groundwater problems at old Santa Ana Pueblo. If the elevation of the adjacent riverbed remains unchanged, the water table elevation in the vicinity of the pueblo is expected to drop 2 to 3 feet. Periodic pumping of the lagoon north of the levee would still be required. Existing piezometers at the dam and at the Santa Ana Pueblo would continue to be monitored. Additional temporary piezometers would be installed to determine water table depth and soil moisture conditions throughout the reservoir area.

Water Quality

The withdrawal of 12,000 acre-feet of water from the sediment pool would not alter water quality within the reservoir itself. Turbidity of the Jemez River below the dam would not increase during the 12,000 acre-foot withdrawal because the remnant pool would still maintain relatively high trap efficiency. During releases, the pool and outflow would be monitored for temperature, pH, dissolved oxygen, and turbidity.

During the evacuation of the final water from the pool in 2001, a minor increase turbidity may occur downstream as sediments along the new channel banks are shifting and are transported downstream. This increase would not exceed turbidity levels experienced during historic operating conditions.

As the inundated area of the sediment pool decreases through evacuation or evaporation and seepage, those areas determined to be below "ordinary high water" (as defined in Section 404 of the Clean Water Act) would likewise decrease. The ultimate ordinary high water elevation would be determined by the Regulatory Branch of the Albuquerque District based on a revised elevation-frequency curve for the reservoir. For the current analysis, it was conservatively assumed that the 500 acres exposed by the withdrawal of 12,000 acre-feet would still be considered below ordinary high water due to the potential for inundation by flood control storage. The bed of a newly formed natural or constructed Jemez River channel within the reservoir area also would be considered jurisdictional waters of the United States.

The proposed channel creation activities would entail excavation of approximately 50 acres and would generate approximately 586,000 cubic yards of waste material. Since the excavated material is essentially undifferentiated from the entire sediment bed which has developed over the past 15 years, waste material would be placed within the area exposed by the pool drawdown. Disposal would entail

approximately 130 acres and waste would both be placed to mimic natural irregularities on floodplains and be spread evenly over selected areas.

Subsequent to the final design of the new channel and initiation of construction, an individual Section 404 permit would be obtained from the Regulatory Branch of the Albuquerque District. Concurrently, a Section 401 Water Quality Certification Permit would be obtained from Region 6 of the U.S. Environmental Protection Agency. A Section 202 Storm Water Pollution Prevention Plan would be prepared by the Government or the construction contractor and a Notice of Intent would be filed with USEPA Region 6. The plan would include the best management practices to be employed to minimize erosion and stormwater runoff from areas disturbed during construction.

Air Quality

The approximately 500 acres of the sediment pool bed exposed after the excavation of 12,000 acre-feet would be highly susceptible to wind and water erosion. Although the limited sediment sampling conducted in 1999 showed no immediate concerns about the metal content of sediments, more extensive surface and subsurface sampling and analysis would be conducted in late 2000 to determine the level of concern for pollutants.

To minimize the immediate possibility of erosion, the newly exposed 500 acres would be stabilized with a temporary grass cover. Winter wheat would be aerially sown at the rate of 80 pounds per acre, along with fertilizer, during late October or early November 2000, while the exposed substrate is still relatively moist. This cool-season grass should sprout within 7 days and provide a stabilizing cover until at least mid-year 2001.

Vegetation

As discussed above, a temporary vegetative cover would be established to minimize erosion. Although establishment of a permanent vegetative cover is desirable, the lateness of the growing season and the uncertainty of the future soil moisture regime precludes establishment or prescription of native herbaceous cover at this time. Groundwater and soil conditions would be evaluated during the ensuing winter and spring to determine an appropriate xeric and/or mesic reseeding mixture for future establishment.

The fairly extensive wetland and riparian vegetation at the reservoir delta would not be adversely affected by the proposed plan. Although groundwater levels are expected to decrease 2 to 3 feet, the delta area would still be subject to periodic inundation by river flow at the current frequency. The final design of the proposed channel in the upper portion of the reservoir would include special consideration of potential effects to vegetation resulting from possible alteration of the river bed elevation through the delta.

Groundwater levels within and immediately adjacent to the existing pool would decrease. This drop would be less pronounced along the northern edge of the reservoir where a strong hydraulic head is produced by the adjacent 400-foot escarpment.

Fish

The decreased sediment pool would sustain the fish population throughout the ensuing months, although the reduced water volume would likely increase competition and predation among fish.

The management of the fish population within the reservoir is the jurisdiction of the Pueblo of Santa Ana. The majority of fish within the pool consist of non-native species and the Pueblo has expressed serious concerns about allowing the fish to pass through Jemez Canyon Dam into the Rio Grande. Non-native fish species can negatively affect native species through predation, hybridization, and competition for resources (Crawford *et al*. 1993). During the release of 12,000 acre-feet from the reservoir, water depth at the dam's intake would be greater than 50 feet and, therefore, would still limit passage of all but a small number of fish.

An extensive study of potential contaminants in fish tissue would be initiated by the Corps in November 2000 to better determine the degree of risk relating to human consumption. If contaminant levels are sufficiently elevated to be of concern, the Pueblo of Santa Ana would likely elect to remove stranded fish (with the assistance of the Corps) prior to the final evacuation of the pool in 2001. Fish would be disposed of by burial in a suitable location well above groundwater level. Although mercury concentrations in tissues may be sufficient to warrant a slight risk for human consumption, it is anticipated they would be small compared to naturally occurring concentrations in watershed soils and would not create a hazard upon burial.

If fish tissue contamination levels are clearly not a health or liability concern, the Pueblo may elect to collect and transport selected sportfish to other lakes or reservoirs in the region if respective fishery managers have expressed an interest. Largemouth bass, channel catfish, and, perhaps white bass, are the likely preferred species for export. Fish rescue operations would be conducted by the Corps prior to the final evacuation of the pool in 2001. Federal, state, or tribal fishery agencies also may assist in the salvage effort.

The cooperation of the City of Albuquerque in the timing of final evacuation of water from the reservoir will be crucial to the implementation of either fish rescue or disposal efforts.

Wildlife

Following the proposed drawdown, a pool of approximately 400 acres would persist through the winter and, most likely, spring migration period; however, wildlife usage would be reduced. This loss of aquatic habitat is considered an unavoidable and immitigable impact because it could only be compensated for by maintaining the existing pool.

Threatened and Endangered Species

As stated in the Agreed Order, supplemental flow (including the release of 12,000 acre-feet from Jemez Canyon Reservoir) is necessary to avoid the potential extirpation of the Rio Grande silvery minnow from reaches of the Rio Grande which would likely go dry during under the current drought conditions. Silvery minnows within the lower Jemez river which cannot find slackwater areas during discharges associated with the release of 12,000 acre-feet would move downstream to the Rio Grande. When Jemez River discharge returns to relatively low-flow conditions, minnows would likely reinhabit the lower reach.

The proposed plan includes channel excavation to prevent severe incision of the Jemez River through the vegetated delta, which includes potential breeding habitat for the Southwestern Willow Flycatcher.

From November 2000 through February 2001, Bald Eagles would still be able to forage at the remaining (approximately 400-acre) sediment pool. Although the density of prey fish in the reduced pool would increase, the areal extent of relatively shallow water suitable for foraging by eagles would decrease. Therefore, prey availability would not likely be significantly different from past winters. Channel construction planned in the upper reservoir would be sufficiently distant (at least one mile) from the majority of the remaining pool to avoid direct disturbance of wintering eagles.

In summary, the proposed plan is not likely to adversely affect federal listed species, and it would have no effect on designated critical habitat of the Rio Grande silvery minnow. The U.S. Fish and Wildlife Service has concurred with this determination during informal consultation under Section 7 of the Endangered Act (see Appendix E).

Recreation and aesthetics

The relatively minor recreational use of the existing pool would be reduced by the drawdown of 12,000 acre-feet and eventually cease when the pool dries up in 2001. Likewise, aesthetic appreciation of the area would be diminished by the reduction and eventual loss of the pool. Visitation to the public use area may also decrease.

These recreational opportunities and aesthetic attributes have been direct, although temporary, benefits of the presence of water within the reservoir since 1979. The loss of these values and opportunities are unavoidable and immitigable.

Land use

Exposure of saturated sediments due to drawdown of the pool would likely result in the demise of cattle that become mired during their attempt to reach the receding water surface. Additionally, cattle would likely prevent the successful establishment of protective vegetative cover through physical disturbance and direct consumption. Therefore, the proposed plan would include the temporary relocation and support of approximately 200 head of cattle currently in the reservoir area. A preliminary management plan developed by the Pueblo of Santa Ana would be facilitated by the Corps. All cattle would be immediately moved to suitably fenced enclosures near the reservoir and provided with supplemental feed and water for approximately 9 months. Concurrently, up to three 40-acre irrigated pastures and associated facilities would be established to sustain cattle for the two or three growing seasons required to establish vegetative cover at the reservoir. The preliminary plan would require approximately 4.5 miles of fencing to enclosure cattle within about 1,230 acres. The fencing would consist of "T-posts" with four-strand barbed wire and vertical railroad crosstie posts at the corners. Two wells and several water tanks would also be installed.

Cultural Resources

Under the proposed plan to release 12,000 acre-feet from the sediment pool, the wave action and sediment deposition affecting cultural resource sites adjacent to the shoreline would cease. Portions of the sites not masked by sediment would be visible; however, the small probability of surface collection or vandalism incidences would not change because non-tribal personnel do not frequent the lake and they generally do not wander around the reservation. Depending upon the rate of water release there may be slight erosion of the downstream channel. The slight erosion has a low probability of impacting archaeological sites.

With the permission of the Pueblo of Santa Ana, archaeologists from the Corps and/or the Bureau of Indian Affairs would conduct cultural resources surveys in order to insure that the fences, wells, and other features associated with cattle enclosures do not impact cultural resources. The actual construction of any fences would cause negligible impacts to sites; however, an issue of concern is the habit of cattle creating incised paths adjacent to the fences. Additionally, the blading of new access roads to cattle enclosures, if required, would have the potential to impact sites within their alignments.

The excavation of the proposed channel within the upper reservoir would cause no impact to cultural resources. The proposed excavation and waste deposition areas would be entirely within the sediment bed deposited since Jemez Canyon Dam began operation in 1953. Surveys would be conducted at the staging area and unpaved access roads to avoid cultural resource sites.

Fish removed from the reservoir for disposal would be buried at a suitable location away from the flood pool and devoid of cultural resource concerns.

Because of the low probability of impact and the conduct of surveys to avoid sites, the Corps has determined that the proposed plan would have no effect on cultural resources. Appendix E contains correspondence with the State Historic Preservation Officer (SHPO), who has verbally concurred with the Corps' determination. The Corps will continue to coordinate with the SHPO as necessary throughout the implementation of the proposed plan.

In the event that cultural resource sites or locations are inadvertently exposed during any phase of the proposed work (*e.g.*, access roads, staging areas, etc.), representatives from the Pueblo of Santa Ana and the Corps would be notified. All work would cease in the vicinity of the discovery and would not be resumed in that location until the appropriate cultural resource entities determined its significance and the appropriate measures to be taken.

Socio-economic Considerations

The proposed evacuation schedule of the Jemez Canyon Reservoir would not significantly affect economic enterprise at the Pueblo of Santa Ana Reservation or in Sandoval County. Public access to the reservoir itself is restricted and, therefore, is not a principal revenue-generating resource in the area.

4.02 NO ACTION ALTERNATIVE

General

Effects resulting from the evacuation schedule under the no-action alternative are very similar to those of the proposed plan; however, the timing of the onset of effects and need to implement mitigative actions under the no-action alternative would occur later in time than under the proposed plan. To avoid unnecessary repetition, the following discussion emphasizes effects which differ from those of the proposed plan and only summarizes those effects and mitigative actions common to both alternatives.

Sedimentation

The diminishing sediment pool would continue to operate with relatively high trap efficiency until its complete evacuation in 2002.

Geomorphology and Hydrology

The size of the sediment pool would gradually diminish through losses. By August 2001, 5,000 acre-feet would likely be evacuated by the City of Albuquerque and the pool elevation will have dropped approximately 11 feet from its present stage. The probability of severe entrenchment of the Jemez River channel in the upper reservoir would become increasing likely through the ensuing months. Channel creation similar to that described under the proposed plan would be executed between November 2001 and February 2002, prior to the 2002 snowmelt runoff period. Compliance with Clean Water Act permitting would be conducted as described under the proposed plan.

No erosion of the Jemez River channel downstream from the dam would be expected with the release schedule under the no action alternative. The relatively small volume (5,000 acre-feet) would allow for release at low (100-200 cfs) discharge rates.

Geology and Groundwater Hydrology

The no-action alternative would not affect the geological characteristics of the area., fault zones in the vicinity of the reservoir, or substrate stability at the dam and outlets works. Bank storage due to the years of impoundment will be released over several years. Groundwater problems at old Santa Ana Pueblo would be alleviated, not eliminated.

Water Quality

Again, because a remnant pool would still function to trap moderate amounts of sediment, and because of the relatively low discharge rates required to release 5,000 acre-feet, only minor increases in downstream turbidity would be expected during the final evacuation of the pool in 2002.

Air Quality and Vegetation

Detailed sampling and analysis of constituents in water, sediment, and biota would begin in fall of 2000. Even if contamination of sediment is not a concern, vegetative cover would still be desirous to minimize nuisance dust. By mid-2001, sufficient acreage of the substrate would be exposed to warrant establishment of cover. A final, rather than temporary, cover of native grasses, herbs, and shrubs would likely be planted with terrestrial equipment during the July-August rainy season.

Fish

The decreasing sediment pool would sustain a diminished fish population through the last stages of the pool in 2002. Fish rescue or disposal would be accomplished prior to the final evacuation of the pool as described under the proposed plan.

Threatened and Endangered Species

The no-action alternative would directly and adversely affect the continued existence and recovery of the Rio Grande silvery minnow and would be directly contrary to the U.S. District Court Agreed Order. Bald Eagle utilization of the diminishing Jemez Canyon Reservoir would be extended for an additional winter period. The no-action alternative is not likely to adversely affect the Southwestern

Willow Flycatcher. It would have no effect on designated critical habitat of the Rio Grande silvery minnow.

Land Use

Cattle within the reservoir area would be exposed to potentially dangerous soil conditions and would hamper establishment of vegetative cover as described for the proposed plan. However, the removal of cattle to temporary enclosures would not be required until the late spring or early summer of 2001 under the no-action alternative. The establishment of irrigated pastures would be initiated in late 2000 to facilitate their use by mid-2001. Temporary feed and water would not be required under the no-action alternative.

Wildlife, Recreation, Aesthetics, and Socio-economic Considerations

Potential effects of the no-action alternative would be similar to those for the proposed plan.

Cultural Resources

Cultural resource concerns are primarily related to the conduct of mitigative actions common to both alternatives, and therefore would be similar to those described under for the proposed plan.

4.03 CUMULATIVE EFFECTS AND FORESEEABLE FUTURE ACTIONS

"Cumulative effect" under the National Environmental Policy Act refers to the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. As discussed previously, the action evaluated in this EA is the immediate withdrawal of 12,000 acre-feet from Jemez Canyon Reservoir for the benefit Rio Grande silvery minnow. The timing of that withdrawal and its immediate effects have been contrasted to the anticipated evacuation schedule of the sediment pool at 5,000 acre-feet per calendar year. The foreseeable action common to either evacuation scenario is, of course, the ultimate elimination of the current sediment pool. This future action and its several potentially adverse environmental effects are currently being evaluated by the Corps and the Pueblo of Santa Ana (see MOU dated September 20, 2000, in Appendix E). During fiscal year 2001, requisite, supporting studies will be conducted, and the Corps will finalize a mitigation plan and all necessary environmental compliance relating to the termination of the pool. Implementation of the plan is expected to continue into fiscal year 2003.

A summary of the Corps' preliminary determination of future, post-pool conditions is presented here to clarify the effects attributable to the immediate withdrawal of 12,000 acre-feet and the actions included in the proposed plan. The following paragraphs describe foreseeable potential effects and likely actions to avoid, minimize, or compensate for those effects.

Dam and outlet works. -- Prior to the establishment of the existing sediment pool, complete closure of the flood control gates was problematic due to sedimentation problems at the intake. This problem was alleviated when a larger sediment pool was established in 1986, but will again become a flood control operation concern after cessation of the pool. A 1984 feasibility study analyzed structural solutions to the problem and recommended either installing cribwalls immediately upstream from the intake or a

multi-level intake structure (Leedshill-Herkenhoff, Inc. 1984). These and other viable alternatives are anticipated to be the focus of a FY01 design study to evaluate structural solutions in context of the changed geomorphological conditions of the Jemez River.

River geomorphology. -- Approximately 2,500 feet upstream from the dam, sediment deposits are 29-feet deep and gradually become more shallow in the upstream direction for about 5 miles (see Plate 11). The proposed plan includes the creation of a new channel to minimize the potential for river entrenchment in the upper portion of the reservoir. After the sediment pool is completely drawn down, the danger of inducing headcutting at the abrupt gradient change near the intake becomes severe. The Corps anticipates (during October 2001 - February 2002) extending the a new channel from the downstream terminus of that in the proposed plan to the dam intake. Bank stabilization (vegetation, bio-engineered features, or hard structures) would likely be required along portions of the channel.

Groundwater. -- Bank storage due to the years of impoundment will be released over several years following the termination of the pool. Piezometers at the old Santa Ana Pueblo will continue to be monitored and additional instruments will be installed throughout the reservoir area. High groundwater problems near the old pueblo will be alleviated to some degree by the absence of the sediment pool, and may be improved further if the bed elevation of the adjacent channel is lowered during proposed channel modifications.

Vegetation. -- An uncontrolled headcut through the reservoir reach would incise the channel through the current delta and would adversely effect existing riparian vegetation by reducing overbank inundation and soil moisture. Channel modifications described above and in the proposed plan would lessen this impact; however, additional riparian plantings are anticipated to be established along portions of the channel in the two years following complete drawdown.

The proposed plan would establish temporary vegetative cover (winter wheat) to stabilize 500 acres of newly exposed sediment bed. After analysis of soil moisture conditions following the drawdown of the pool, an appropriate mixture of herbaceous and shrub species is expected to be established throughout the reservoir space. The potential for infestation of the exposed substrate by salt cedar is high, especially along the margins of the former sediment pool. Germination may be partially controlled by the temporary wheat cover; however, mechanical or herbicidal control of salt cedar seedlings may be required before establishing native herbaceous vegetation. After such treatment and the determination of expected soil moisture conditions, native grass and shrub cover could be established.

Air and water quality. -- As stated under the proposed action, additional sampling and analysis of constituents throughout the sediment bed will be performed in late 2000. The final mitigation plan will address any concerns regarding air and water quality.

Fish and wildlife habitat. -- The presence of a pool at Jemez Canyon Reservoir since 1979 has been a substantial yet temporary benefit to fish and wildlife. The loss of aquatic habitat due to the termination of the sediment pool is an unavoidable and immitigable impact.

Land use. -- As described in the proposed plan, cattle would be immediately removed from the reservoir area to prevent their demise in newly exposed, saturated substrate and to facilitate the establishment of vegetative cover. After establishment of native vegetative cover, two to three years of growth would be required before the reintroduction of grazing. During this interim period, enclosures and irrigated pasture adjacent to the reservoir would be provided.

The Pueblo of Santa Ana will be formulating a land use plan for the reservoir area following the elimination of the sediment pool. In the interest of stewardship and to fulfill their trust responsibilities, the Corps will assiduously assist the Pueblo in the formulation and implementation of their land use plans.

5. SUMMARY AND CONCLUSION

The Jemez Canyon Dam and Reservoir Project was authorized by the Flood Control Acts of 1948 (P.L. 80-858) and 1950 (P.L. 81-516) for flood damage reduction and sediment retention. Construction of the dam began May 1950 and the facility was completed and placed into operation in October 1953. All lands associated with Project (approx. 6,711 ac.) are held in trust by the United States for the benefit and use of the Pueblo of Santa Ana.

The reservoir did not include a permanent pool for the first 26 years of operation. In 1979, the Corps and the New Mexico Interstate Stream Commission (NMISC) agreed to establish a 2,000-acre-foot sediment retention pool. To yet further improve sediment retention, the Corps and NMISC agreed in a 1986 Memorandum of Understanding (MOU) to store water within the remaining sediment storage space (elevation 5196.7 feet), as much as 29,712 acre-feet at that time. The NMISC leased San Juan-Chama Project water from the City of Albuquerque and its storage was facilitated by exchange with San Juan-Chama Project water released down the Rio Grande. The average size of Jemez Canyon Reservoir for the past 15 years has been 1,000 to 1,200 acres.

The Corps-NMISC storage agreement will expire on December 31, 2000 (the MOU's original expiration date). Factors influencing this decision include significantly increased demands on available water in the region, it's increasing cost, and need for increased sediment loading to the currently degrading Rio Grande channel (which was aggrading in the 1930s through 1980s). The Corps-NMISC MOU states that, at the end of the agreement, the remaining sediment pool may be drawn down at the rate of 5,000 acre-feet per calendar year. According to the NMISC-City of Albuquerque lease agreement, ownership of the remaining water in the sediment pool reverts to the City.

The eventual termination of the sediment pool is not within the scope of the federal action evaluated in this Environmental Assessment. The Corps currently is conducting studies and will develop in 2001 a final plan to address associated environmental concerns and issues, including: potential entrenchment of Jemez River for 5.5 miles upstream from dam; water and wind erosion of potential contaminants in exposed sediments; problems with proper flood gate closure due to sediment; revegetation and grazing within the reservoir area; and the Government's stewardship and trust responsibilities. Implementation of actions to address these concerns would continue through 2003.

In November 1999, a coalition of environmental groups filed suit (*Rio Grande Silvery Minnow, et al,. vs. Eluid L. Martinez, et al.*) against the U.S. Government for failure to comply with the Endangered Species Act relative to planned water operations and river maintenance activities along the Rio Grande and its tributaries. In response to much lower-than-average flows during 2000, the plaintiffs filed a Motion for Preliminary Injunction to maintain flows in the middle Rio Grande in a manner which would be sufficient to prevent the river from drying, particularly in the reach below the San Acacia Diversion Dam. In lieu of an injunction, the U.S. District Court ordered mediation amongst all parties. Part of the Agreed Order provides for up to 85,900 acre-feet of water to meet the objective of maintaining river flows, which specifically includes up to 12,000 acre-feet from the current sediment pool in Jemez Canyon Reservoir.

Release of water from the reservoir would require the Corps and NMISC to amend the 1986 sediment pool storage MOU to allow up to 12,000 acre-feet to be released in 2000, and approval of a

deviation from the current water control plan from South Pacific Division of the Corps. This federal actions entailed the need for this Environmental Assessment (EA).

The proposed action evaluated in this EA entails the method, timing, and potential effects of the release of 12,000 acre-feet of water from the reservoir during September through October 2000. The proposed plan is compared to the method, timing, and potential effects of the no-action alternative of releasing up to 5,000 acre-feet per calendar year during 2001 and 2002. Because no proposals for the provision of water to continue storage for sediment retention at Jemez Canyon Reservoir have been proffered by regional water management entities, that action was not considered a reasonable alternative for evaluation in this EA.

The proposed plan would release up to 12,000 acre-feet from the current (approximately 17,000 acre-foot) sediment pool at Jemez Canyon Reservoir in September through October 2000. Releases would be made at the lowest discharge rates practicable (ranging from 150 to 600 cfs) to facilitate timely delivery. All releases would be coordinated with natural flow and discharges from other reservoirs in the Rio Grande system. The proposed plan includes several measures to avoid, minimize, or compensate for potential adverse effects. As soon as practicable after the release of 12,000 acre-feet, temporary vegetative cover would be established on approximately 500 acres of the exposed sediment bed to minimize erosion by wind or water. Detailed sampling and analysis of the constituents in water, sediment, and biota would begin early in FY 2001 to determine if metal concentrations pose any health risk to humans. Approximately 200 head of cattle would immediately be relocated to temporary enclosures to prevent their demise in exposed, saturated sediments, and to prevent disturbance of the temporary vegetative cover. Supplemental feed and water would be provided to cattle for up to 9 months until irrigated pastures could be established. Beginning in January 2001, a 3.3-mile-long channel would be excavated within the upper portion of the reservoir to prevent severe headcutting by spring snowmelt runoff. Fish would be salvaged from the remaining sediment pool in 2001 and, due to concerns about elevated mercury concentrations, would likely be disposed of through burial in an appropriate location.

Prior to implementation of channel excavation under the proposed plan, an individual permit relative to Section 404 of the Clean Water Act would be obtained from the Albuquerque District Regulatory Branch, and a Section 401 Water Quality Certification Permit would be obtained from the U.S. Environmental Protection Agency, Region 6.

The potential effects and mitigative actions included in the proposed plan are largely similar to those of the no-action alternative, with the exception of timing. Under the proposed plan, effects would become substantive six to twenty months sooner than under the no-action scenario. The no-action alternative would directly and adversely affect the continued existence and recovery of the Rio Grande silvery minnow and would be directly contrary to the U.S. District Court Agreed Order.

In consideration of the relative effects to the human environment evaluated in this Environmental Assessment, the proposed plan is recommended for implementation.

6. PREPARATION, COORDINATION, AND REVIEW

6.01 PREPARATION AND COORDINATION

This Environmental Assessment document was prepared by the U.S. Army Corps of Engineers, Albuquerque District. Principal preparers included:

Alan CDeBaca	Cost Estimator. 15 years experience.
William DeRagon	Biologist/Team Leader. B.S. Wildlife Management, M.S. Wetland and Wildlife Ecology. 17 years experience in wildlife, wetland, and riparian ecology; 10 years NEPA and compliance experience; 5 years project management experience.
Darrell Eidson, P.E.	Hydraulic Engineer. B.S. Civil Engineering. 10 years experience in hydrology, hydraulics, sedimentation, and river restoration.
Donald Gallegos	Hydraulic Engineer. B.S. Civil Engineering. 19 years experience in river and reservoir operations, computer modeling, and reservoir sedimentation.
Brian Jordan	Chemist. B.S. Chemistry. 6 years experience in environmental chemistry.
James McAdoo, P.G.	Geologist. B.S. Geology. 28 years experience in engineering geology and groundwater hydrology.
Cynthia Piirto	Outdoor Recreation Planner. 20 years experience in recreation and natural resources management.
John Schelberg, Ph.D.	Archaeologist.
Deborah Smith	Civil Engineer. B.S. Civil Engineering. 11 years experience.

Supervisory review and oversight were provided by:

Dale Gronewold	Chief, Operations Division
Mark Harberg	Chief, Environmental Resources Branch
Frank Jaramillo	Chief, Hydrology and Hydraulics Section
Dick Kreiner	Chief, Reservoir Control Branch
Carol McKinney	Chief, Geotechnical and HTRW Section

The cooperation of the following representatives of the Pueblo of Santa Ana was crucial in the preparation of this document:

Roy Montoya	Tribal Administrator
Todd Caplan	Director, Department of Natural Resources
James Zokan	Watershed/Rangeland Program Manager, Dept. of Natural Resources
Les Ramirez	Counsel

Mike Sporcic, State Agronomist, USDA-Natural Resources Conservation Service, provided valuable assistance with reseeding plans.

6.02 REVIEW OF THE DRAFT ENVIRONMENTAL ASSESSMENT

Because of the strict and immediate schedule of releases required by the U.S. District Court Agreed Order, the public review period for the Draft Environmental Assessment consisted of eight calendar days, from September 11 through September, 2000. Availability of the Draft EA was advertised daily in the Albuquerque Journal, Albuquerque Tribune, and Albuquerque Journal North.

Paper copies of the document were available for review at:

- Albuquerque Public Library, Main Branch, 501 Copper Ave. NW, Albuquerque;
- Bernalillo Roosevelt Public Library, 134 Calle Malinche, Bernalillo;
- Esther Bone Memorial Library, 950 Pinetree Road, Rio Rancho;
- Santa Fe Public Library, Main Branch, 145 Washington Ave., Santa Fe;
- Pueblo of Santa Ana, Dept. of Natural Resources, 51 Jemez Canyon Dam Rd., Bernalillo; and
- U.S. Army Corps of Engineers, 4101 Jefferson Plaza NE, Albuquerque.

The document was primarily available in digital format at the Albuquerque District's web page: http://www.spa.usace.army.mil . The following federal, state, tribal, and private entities, and their respective engineering consultants, were notified of the availability of the Draft EA through verbal or electronic mail notification. (Not listed here are numerous private citizens who were notified of the document's availability through the mailing list of the Upper Rio Grande Water Operations Review.)

Ayres Associates
Battelle, Inc.
Bernalillo County
CHM2Hill, Inc.
City of Albuquerque
City of Española
City of Rio Rancho
City of Santa Fe
Defenders of Wildlife
Ecosystem Management, Inc.
FLO Engineering, Inc.
Forest Guardians
International Boundary Water Commission
Los Alamos National Laboratory
Middle Rio Grande Council of Governments
Middle Rio Grande Conservancy District
National Audubon Society
New Mexico Audubon Council
New Mexico Cattle Growers Association
New Mexico State University, Water Resources Research Institute
New Mexico Tech, Department of Geoscience
Parsons Engineering Science, Inc.
Pueblo of Isleta
Pueblo of Cochiti
Pueblo of Santa Ana
Pueblo of Santa Clara
Pueblo of San Juan
Pueblo of Zia
Rio Grande Compact Commissioners (from CO, NM, and TX)
Rio Grande Restoration
Sandia National Laboratory
Sandoval County
Santa Fe County
Santa Fe New Mexican
Science Applications International Corporation
Sierra Club
State of New Mexico, Attorney General's Office
State of New Mexico, Dept. of Game and Fish
State of New Mexico, Environment Department
State of New Mexico, Interstate Stream Comm.
State of New Mexico, Minerals and Natural Resources Department
State of New Mexico, Office of Cultural Affairs, Historic Preservation Division

State of New Mexico, State Engineers Office
State of New Mexico, State Historic Preservation Officer
S.S. Papadopulos & Associates, Inc.
Southwest Organizing Project
Southwestern Environmental Center
Town of Bernalillo
University of New Mexico, Dept. of Biology
U.S. Army Corps of Engineers, Albuquerque District Regulatory Branch
U.S. Bureau of Indian Affairs, Southern Pueblos Agency
U.S. Bureau of Reclamation, Albuquerque Area Office
U.S. Bureau of Reclamation, Regional Area Office
U.S. Department of Energy, LANL
U.S. Forest Service, Santa Fe National Forest
U.S. Forest Service, Southwest Regional Office
U.S. Department of Interior, IOS
U.S. Department of Justice
U.S. Environmental Protection Agency, Region 6
U.S. Fish and Wildlife Service, New Mexico State Ecological Services Office
U.S. Fish and Wildlife Service, New Mexico Fishery Resources Office
U.S. Fish and Wildlife Service, Region 2
U.S. Geological Survey, New Mexico Water Resources Office
U.S. Geological Survey, Biological Resources Division, Jemez Mountains Research Station
U.S. Natural Resources Conservation Service, New Mexico State Office
U.S. Park Service, Bandelier National Monument
Water Dialogue
William J. Miller Engineers

The electronic mail notice consisted of:

DRAFT ENVIRONMENTAL ASSESSMENT FOR REVIEW: PARTIAL EVACUATION OF THE SEDIMENT POOL AT JEMEZ CANYON RESERVOIR, SANDOVAL COUNTY, NEW MEXICO

The U.S. Army Corps of Engineers proposes to release 12,000 acre-feet of water from Jemez Canyon Reservoir, Sandoval County, NM, during September-October 2000. Because of the immediate need to release this water in support of downstream populations of the Rio Grande silvery minnow, the review period for this document is **eight (8) days, September 11 - 18**, 2000.

The document is available in Acrobat (.pdf) format at <http://www.spa.usace.army.mil> and ftp://ftp.spa.usace.army.mil/jemez/ (the latter site includes Word and html versions also).

Hardcopies are available for review at the Albuquerque Public Library, Main Branch; Bernalillo Public Library, Bernalillo; Santa Fe Public Library, Main Branch; Rio Rancho Public Library; the Pueblo of Santa Ana Department of Natural Resources. Availability is being advertised daily in The Albuquerque Journal, The Journal North, and The Albuquerque Tribune.

Please address all comments and requests for copies to: William DeRagon, U.S. Army Corps of Engineers, 4101 Jefferson Plaza NE, Albuquerque, NM 87109; **preferably by telephone**: 505-342-3358 or 342-3353, **or by e-mail**: william.r.deragon@usace.army.mil, **or by FAX**: 505-342-3668.

*** Please forward this message to anyone whom you think may be interested. ***
We apologize if this is a duplicate message -- several lists have been consolidated.
The recipient list accompanying this message represents only a portion of the total mailing.

All review comments received on the Draft EA are included in Appendix D.

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PLATES

1. Storage capacity under the proposed and no-action alternatives.
2. Location map – Reservoir area.
3. Jemez Canyon Dam and Reservoir -- Watershed map.
4. Percentage of annual flow and precipitation.
5. Inflow and outflow frequency curves.
6. Thalweg profiles.
7. Sedimentation and degradation ranges.
8. Degradation ranges D-3, D-5, D-6 and D-7.
9. Degradation ranges D-8, D-9 and D-10.
10. Degradation ranges D-11, D-12, D-13 and D-14.
11. Longitudinal profiles of reservoir.