

UPPER RIO GRANDE WATER OPERATIONS REVIEW AND EIS

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INTRODUCTION

This draft programmatic environmental impact statement (EIS) considers the effects of adopting an integrated plan for water operations in the upper Rio Grande basin. The basin includes the Rio Grande from its headwaters in Colorado through New Mexico to just above Fort Quitman, Texas. The development of this EIS is the result of a Memorandum of Agreement (MOA), signed in 2000, defining the scope, purpose, and need for the project, the rules and responsibilities of each Joint Lead Agency (JLA) entering into the agreement, and the organizational structure for participation and oversight. The JLAs for this EIS are the U.S. Bureau of Reclamation (Reclamation), the U.S. Army Corps of Engineers (Corps), and the New Mexico Interstate Stream Commission (NMISC).

This EIS is prepared in accordance with the National Environmental Policy Act of 1969 (NEPA), as amended to identify and assess potentially significant environmental, economic and social impacts and address other issues associated with changes in water operations. Several distinct federal and state agencies with differing missions and methods are responsible for legislating, managing, and distributing water. Several inter- and intra-state agreements mandate the delivery of certain volumes of water between federal, state, local and tribal entities. The portion of the river designated as the upper Rio Grande is subject to the Rio Grande Compact signed on March 18, 1938; ratified by the States of Colorado, New Mexico, and Texas in 1939; and signed by the President of the United States on May 31, 1939.

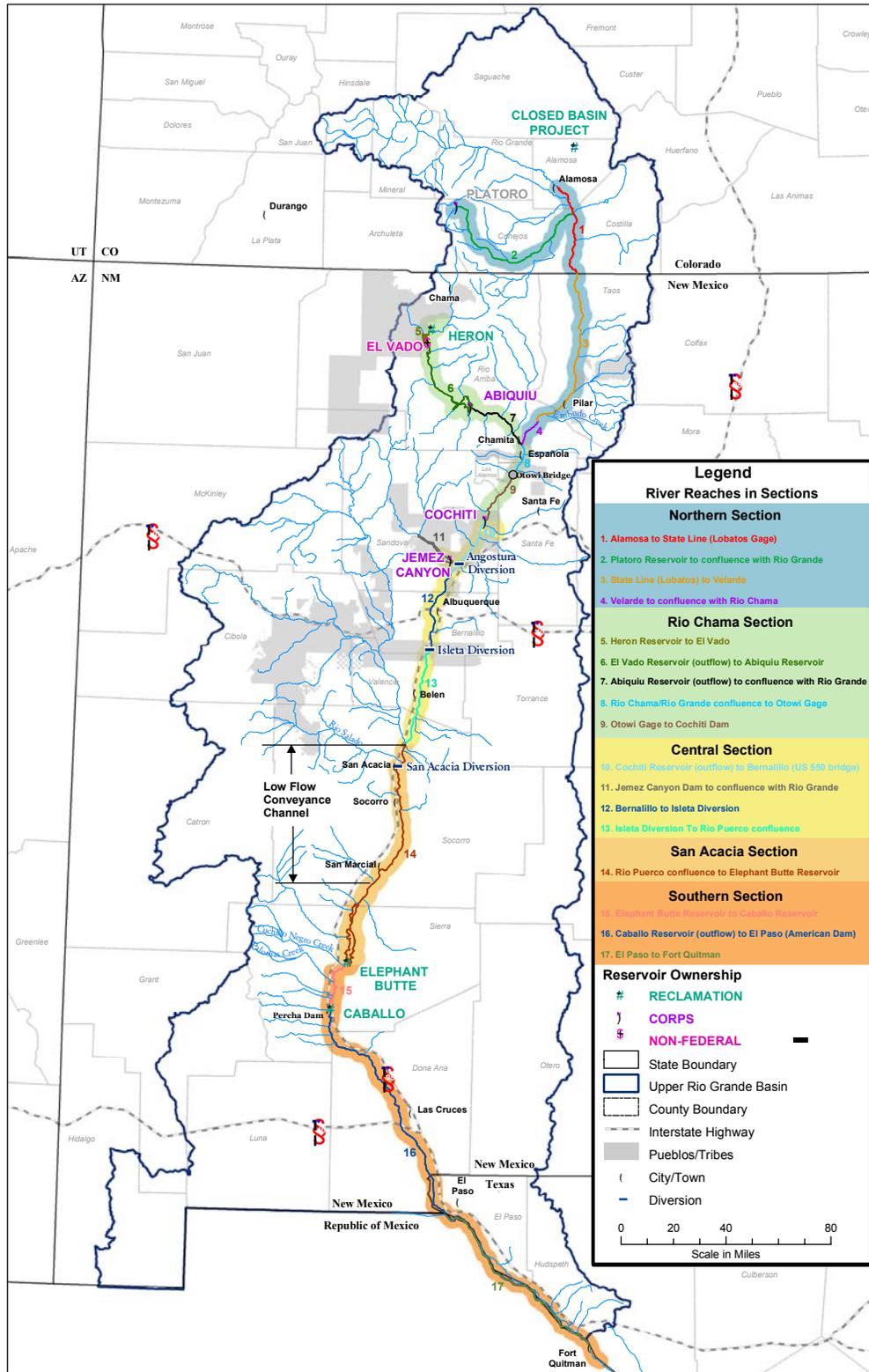
Ten water operations facilities in this basin can be manipulated individually or in concert to address various situations. Five facilities are located on tributaries: Heron and El Vado Reservoirs operated by the U.S. Bureau of Reclamation (Reclamation), and Platoro, Abiquiu, and Jemez Canyon Reservoirs operated by the U.S. Army Corps of Engineers (Corps). The remaining facilities are on the mainstem of the Rio Grande, including Closed Basin Project operated by Reclamation in Colorado, Cochiti Reservoir operated by the Corps, and the Low Flow Conveyance Channel (LFCC), operated by Reclamation. In addition, two Reclamation facilities on the mainstem—Elephant Butte and Caballo Reservoirs—have operations limited to flood control under the scope of this EIS. **Map 1** shows these facilities and highlights key features of the upper Rio Grande system. The New Mexico Interstate Stream Commission (NMISC) is responsible for Compact deliveries to Elephant Butte Reservoir, including, but not limited to, oversight of federal reservoir operations and accounting of native Rio Grande and San Juan-Chama (SJC) Project contract water.

PURPOSE AND NEED FOR ACTION

Water management in the upper Rio Grande basin has evolved over decades, the result of separate and distinct authorizing legislation involving various federal and state agencies with differing missions and methods. Agency coordination became critical in the mid-1990s with the designation of two endangered species under the federal Endangered Species Act (ESA). To meet species and habitat needs, manage flows in the highly variable flow regime of the Rio Grande, and satisfy competing water demands exacerbated by a multiple-year drought, cooperative efforts were needed. The goal was to evaluate a full range of water operations and to develop an integrated plan for water operations at their existing facilities in the upper Rio Grande basin. The JLA adopted the following purpose and need statements for this Review and EIS.

Purpose: The Water Operations Review will be the basis of, and integral to, the preparation of the Water Operations EIS. The purposes of the Review and EIS are to:

1. Identify flexibilities in operation of federal reservoirs and facilities in the upper Rio Grande Basin that are within existing authorities of the Corps, Reclamation, and NMISC and that are in compliance with state and federal law.



Map 1. Key Reaches and Features of the Upper Rio Grande Basin

2. Develop a better understanding of how these facilities could be operated more efficiently and effectively as an integrated system.
3. Formulate a plan for future water operations at these facilities that is within the existing authorities of the Corps, Reclamation, and NMISC, that complies with state, federal, and other applicable laws and regulations, and that assures continued safe dam operations.
4. Improve processes for making decisions about water operations through better interagency communications and coordination, and facilitation of public review and input.
5. Support compliance of the Corps, Reclamation, and NMISC with applicable laws and regulations, including, but not limited to, NEPA and the ESA.

Need: Under various existing legal authorities, and subject to the allocation of supplies and priority of water rights under state law, the Corps and Reclamation operate dams, reservoirs, and other facilities in the upper Rio Grande basin to:

1. Store and deliver water for agricultural, domestic, municipal, industrial, and environmental uses.
2. Assist the NMISC in meeting downstream water delivery obligations mandated by the Rio Grande Compact of 1938.
3. Provide flood protection and sediment control.
4. Comply with existing laws, contract obligations, and international treaties.

AGENCY COORDINATION AND PUBLIC INVOLVEMENT

Five Cooperating Agencies, Bureau of Indian Affairs, U.S. Fish and Wildlife Service, New Mexico Department of Agriculture, New Mexico Environment Department, Pueblo of San Juan, signed formal agreements for participation in this Review and EIS. Each of these Cooperating Agencies provided team members and/or leadership on technical teams, contributed to review of findings during monthly Interdisciplinary NEPA Team meetings, and participated on the Steering Committee (**Figure 1**). The Interdisciplinary NEPA Team also included the participation of technical experts from other participating agencies. Project oversight and responsibility is the function of the Executive Committee, composed of the local officials of the lead agencies, which also provided project managers. The Steering Committee, composed of agency and tribal personnel, as well as interested stakeholders, facilitates coordination and information exchange with no decision-making role. Representatives from over 45 agencies and stakeholders participated on technical resource teams, Interdisciplinary NEPA team meetings, and other public meetings over the course of this Review and EIS.

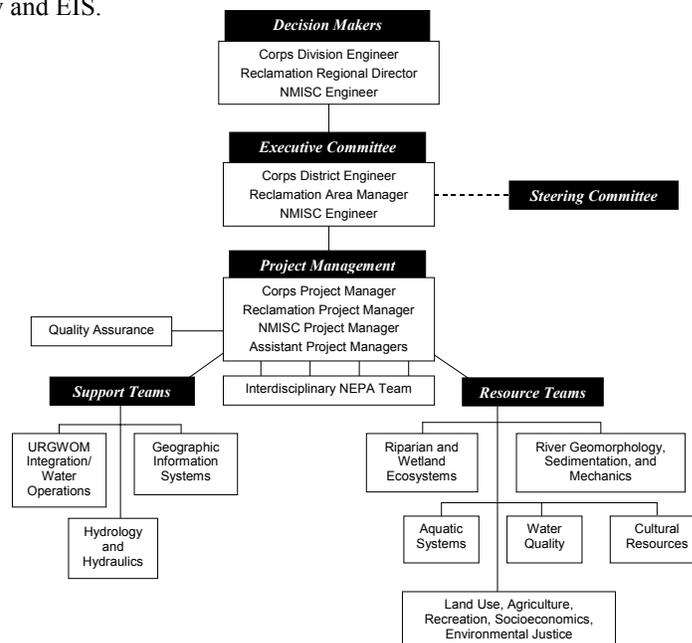


Figure 1: Organizational Chart for the Water Operations EIS

PUBLIC INVOLVEMENT

In accordance with NEPA guidelines, a Notice of Intent (NOI) to prepare this EIS was published in the *Federal Register* on March 7, 2000. During the scoping process in 2000, meeting attendees expressed an interest in learning about the water operation alternatives. In addition to a Steering Committee meeting, 10 public meetings were held in 2002 to discuss possible components of the alternatives and the strategy for developing them further in accordance with NEPA. Using the comments from the public, other agencies, and industry representatives, the interdisciplinary team identified issues to be evaluated, as follows:

Low Flows: Improving water operations management flexibility during low flows is an important goal of this Review and EIS. While many of the operations and much of the infrastructure along the Rio Grande were developed to manage flood flows, in reality, the river is prone to drought and historically subject to frequent low flows that periodically leave parts of the channel dry and lead to increased sediment deposition.

Endangered Species: The river and adjacent riparian areas provide habitat to federally-listed endangered species, including the Rio Grande silvery minnow and the southwestern willow flycatcher. Provisions of the ESA require that operation of the river be consistent with the protection of listed species. The Review and EIS examines how changes to water operations may improve or maintain habitat for these species. As this is a 40-year planning study, the specific requirements of any current Biological Opinion were not considered in the analyses.

Water Conveyance Efficiency: The Review and EIS examine improved efficiency in water conveyance through increased operational flexibility and coordination. Efficient conveyance of water to Elephant Butte Reservoir helps the United States meet its water delivery obligation to Mexico and helps the State of New Mexico meet its obligations under the Rio Grande Compact.

Sediment Management and Flood Capacity of the Channel: The Review and EIS evaluates improved operations with the ability to mobilize sediment and keep the floodway open for flood flows. Management of the Rio Grande's heavy sediment load is fundamental to successful management of the river and its effect on adjacent lands. Adequate channel and floodway capacity are required to allow the higher flows of the Rio Grande to pass safely.

KEY TOOLS

Due to the complexity and scope of the Review, a number of tools were developed and used in the evaluation of proposed plans for water operation. The Upper Rio Grande Water Operations Model (URGWOM) was the primary tool used for analysis and data projection. The URGWOM planning model is a software package that simulates hydrologic response to changes in reservoir operation, channel capacity, or water diversion based on defined physical characteristics of the system.

For modeling purposes, a 40-year hydrologic period was used. Daily water data for the years 1975-2000 were analyzed and randomly sampled to generate a hypothetical data set. These years were then projected from the year 2000 to the year 2040. In order to simulate a full range of possible hydrologic conditions that might be experienced in such a period, the sequence included a wet period, a drier than average period and a period of extreme drought. Most of the analyses of alternatives was based on data generated by this hypothetical 40-year projection. The model also considered typical irrigation demands and demands of the City of Albuquerque Drinking Water Project, assumed to be operating by year 4 of the 40-year planning period.

Other important tools in the review and EIS included FLO-2D, RMA-2/Aquatic Habitat Model, San Acacia Surface Water/Groundwater Model, and Geographic Information Systems (GIS) spatial analysis. The Criterium Decision Plus decision support model was used to aid in comparing and contrasting results of the alternatives. This suite of tools provides the best available information concerning the operation of the Rio Grande system.

ALTERNATIVES EVALUATED IN DETAIL

No Action Alternative: The No Action Alternative is the water operations alternative that depicts current storage and water delivery operations of federal facilities, including those changes in the system that are already published in the public record and will occur in the foreseeable future. For this project, it specifically means current operation of the ten water operations facilities in the basin, without integrating any of the flexibilities identified at Heron and Abiquiu Dams, Cochiti Lake, or the LFCC into a water operation plan (see Map S-1). The authorized function and current operation of each facility in the No Action Alternative that was considered and would be potentially affected by proposed changes is described briefly below:

Closed Basin Project (Reclamation): Located near Alamosa, Colorado, the Project uses wells to salvage groundwater from high water table conditions to assist Colorado in meeting its Rio Grande Compact delivery obligations. Salvaged groundwater varies in quality and is therefore blended to meet quality requirements of the Rio Grande Compact and the Clean Water Act. A network of observation wells monitors water levels in the underlying confined and unconfined aquifers to ensure that operations are within drawdown limits prescribed by the authorizing legislation. Well degradation and fouling is now limiting production. A well rehabilitation and replacement program is in progress.

Platoro Dam (Reclamation): Also in Colorado, Platoro Dam on the Conejos River is operated by the Conejos Water Conservancy District. A joint-use pool is used for both flood space and conservation; if flood space is needed, water in conservation storage is released to make room. A small permanent pool is maintained for recreation, fish, and wildlife. Platoro is managed to preserve fish and wildlife downstream. Flood control operation is the responsibility of the Corps and is the only function under review under the scope of this project.

Heron Dam (Reclamation): Heron Dam on Willow Creek in northern New Mexico stores no native Rio Grande water, therefore, this reservoir is not subject to Compact requirements. It was built in the late 1960s to store water from the upper Colorado River system and to import it to the Rio Grande through the San Juan-Chama (SJC) Project. Reclamation stores water in Heron Reservoir to meet the demands of its SJC Project water contractors who are required to take delivery of their annual allotment by December 31 of the irrigation year.

El Vado Dam (Reclamation): El Vado Dam is located on the Rio Chama. This reservoir was not part of the Review due to active litigation and changes to its operations were not considered.

Abiquiu Dam (Corps): Abiquiu Dam, also on the Rio Chama, is operated as a flood control facility. During flood control operations, water is released at a rate of up to 1,800 cubic feet per second (cfs) to evacuate the reservoir and maintain safe channel capacity downstream. The reservoir can also be used to store SJC Project water up to an elevation of 6,220 feet. The City of Albuquerque owns storage easements up to this elevation and has a current contract with the Corps to store SJC Project water in this incidental pool. The reservoir is also authorized to store native Rio Grande water in the SJC Project water space when this space is not needed. Such storage is subject to other requirements such as a state engineer permit, a Corps deviation from normal operations, and unanimous concurrence of the deviation by the Compact Commission.

Cochiti Dam (Corps): Cochiti Dam is sediment and flood control structure located primarily on Pueblo of Cochiti lands. The Pueblo of Cochiti provided easements and rights-of-way for the facility and the Corps coordinates with the Pueblo on actions involving this reservoir. Cochiti Dam spans the main stem of the Rio Grande and the Santa Fe River tributary to the Rio Grande on Pueblo land, south of Santa Fe, New Mexico. The Corps has specific requirements for holding and releasing carry-over native Rio Grande floodwater in the facility. A permanent pool of SJC Project water is maintained in Cochiti Lake for recreation, fish, and wildlife. There is no authorization to store native Rio Grande water in Cochiti Lake.

Jemez Canyon Dam (Corps): A sediment and flood control structure on the Rio Jemez, Jemez Canyon Dam is operated as a dry reservoir. The dam and reservoir area are on Pueblo of Santa Ana lands and the Corps coordinates with the Pueblo on actions involving this reservoir. There are no water contracts in place or proposed for re-establishing a sediment pool.

Low Flow Conveyance Channel (Reclamation): The LFCC was constructed in the 1950s to aid delivery of Compact waters to Elephant Butte Reservoir. It also served to improve drainage and supplement water supply for irrigation. The riprap-lined channel parallels an approximately 60-mile reach in the San Acacia Section of the Rio Grande from San Acacia to San Marcial, New Mexico. The LFCC collects river seepage and irrigation surface and subsurface return flows, thus reducing evaporation. The usefulness of the LFCC is dependent upon the water level of Elephant Butte Reservoir. When outfall conditions allow, up to 2,000 cfs can be diverted into the LFCC at San Acacia. The LFCC also provides water to both Bosque del Apache National Wildlife Refuge and to irrigators in the Middle Rio Grande Conservancy District.

Elephant Butte Dam (Reclamation): Elephant Butte Reservoir is the primary water storage facility for Rio Grande Project water, delivered primarily to New Mexican, Texan, and Mexican irrigators living downstream of Caballo Reservoir. However, release of water for delivery to the downstream entities was not addressed in the Review and EIS. Generation of hydropower is a secondary purpose of the facility. Operation of the facilities for “prudent flood space” was included in the scope of this Review and EIS. A 50,000 acre-foot (AF) flood space is maintained from April 1 to September 30; 25,000 AF of flood space is reserved between October 1 and March 31. Flood release is required when the reservoir level is within the prudent flood space.

Action Alternatives: Based on public scoping, review of historic hydrologic extremes, and considering the breadth of possible events that could occur within a 40-year planning period, draft operational plans (designated by letters) were developed using combinations of facility-specific actions. These plans were further differentiated (designated by numbers) recognizing natural limitations and operational feasibilities under a range of climatic conditions. Some draft alternatives necessarily fell out in the initial screening process through application of the three preliminary screening criteria presented in the public scoping meetings: (1) the alternative is physically possible; (2) the alternative meets the Memorandum of Agreement purpose and need statement; and (3) the alternative is within the existing authorities of the agencies involved.

Action alternatives considered for detailed analysis were selected based on a review of preliminary URGWOM planning version results using the three threshold screening criteria, together with detailed water operations performance measures developed by the Water Operations Support Team, as well as consideration of significant issues identified by the public in the draft alternatives meetings. Threshold criteria included dam safety and flood control operations, Compact compliance, and meeting contractual water supply obligations. The alternatives which emerged from the screening process that are considered for implementation are listed below. Table 1 provides a brief synopsis of the key features of each alternative, listed by proposed changes from the No Action Alternative and organized by each facility identified as possessing operational flexibility.

Table 1. Comparison of Alternatives Analyzed

Alternatives	Operation/Facility						
	Heron Waivers	Abiquiu Storage Capacity	Abiquiu Channel Capacity	Cochiti Channel Capacity	Diversions to LFCC	Elephant Butte and Caballo	Basin-wide
No Action ¹	April 30	0 AF ³	1,800 cfs ⁴	7,000 cfs	0–2,000 cfs	Informal coordination	Informal communication
B-3	Sept. 30	0–180,000 AF	1,500 cfs	8,500 cfs	No Change*	Protocol/coordination	Improved communications
D-3	Aug. 31	0–180,000 AF	2,000 cfs	No Change	No Change	Protocol/coordination	Improved communications
E-3 ²	Sept. 30	0–180,000 AF	No Change	10,000 cfs	No Change	Protocol/coordination	Improved communications
I-1	No Change	0–20,000 AF	No Change	No Change	0–500 cfs	Protocol/coordination	Improved communications
I-2	No Change	0–75,000 AF	No Change	No Change	0–1,000 cfs	Protocol/coordination	Improved communications
I-3	No Change	0–180,000 AF	No Change	No Change	No Change	Protocol/coordination	Improved communications

*Note: *No Change* means no difference from No Action alternative. Modeled diversions to the LFCC begin only when there is at least 250 cfs in the river.

¹ Least flexible alternative. ² Most flexible alternative. ³ AF = Acre feet. ⁴ cfs = Cubic feet per second.

The action alternatives are briefly described below.

Alternative B-3: Alternative B-3 was chosen as an action alternative in order to evaluate the impacts of later water delivery (September 30 as opposed to April 30) from Heron Dam, to take advantage of the flexibility available to store native Rio Grande water in Abiquiu Reservoir, consider lower flows below Abiquiu Dam, and higher flows below Cochiti Dam.

Alternative D-3: The primary differences between Alternative D-3 and the No Action Alternative are a later Heron waiver date (August 31), storage of native Rio Grande water in Abiquiu Reservoir, and a higher maximum flow below Abiquiu Dam.

Alternative E-3: The primary differences between Alternative E-3 and the No Action Alternative are a later Heron waiver date (September 30), storage of native Rio Grande water in Abiquiu Reservoir, and a higher maximum flow in the channels below Abiquiu Dam and Cochiti Dam.

Alternative I-1: The primary differences between Alternative I-1 and the No Action Alternative are storage of native Rio Grande water in Abiquiu Reservoir and a lower maximum diversion into the LFCC. These variations from No Action were included in an alternative to address concerns from the Interdisciplinary NEPA Team that a greater range of upstream storage and LFCC diversions should be analyzed in order to better understand the impacts to resources along the Rio Chama and the Rio Grande. It was also developed to increase the variation between alternatives in compliance with NEPA requirements.

Alternative I-2: The primary differences between Alternative I-2 and the No Action Alternative are higher (greater than Alt. I-1) amounts of storage of native Rio Grande water in Abiquiu Reservoir and a lower maximum diversion into the LFCC. These variations were included in an alternative to address the same concerns from the Interdisciplinary NEPA Team as noted in Alternative I-1.

Alternative I-3: The primary differences between Alternative I-3 and the No Action Alternative are high amounts of storage of native Rio Grande water in Abiquiu Reservoir and the maximum authorized diversion into the LFCC. These variations from No Action were included in an alternative to analyze the impacts to the system through exercising maximum flexibility in upstream storage and LFCC diversions in order to better understand the impacts on resources along the Rio Chama and the Rio Grande.

PREFERRED ALTERNATIVE

The Preferred Alternative was identified based on the resource impacts and performance relative to weighted decision criteria developed for the decision support system as shown on **Figure 2**. By applying the rankings derived from the criteria in the decision-support software, Alternative B-3 was identified as the preferred alternative. This alternative is not the same as the environmentally preferable alternative, but was selected because it was the best at meeting the most criteria. No alternative was determined to be ideal for all resources.

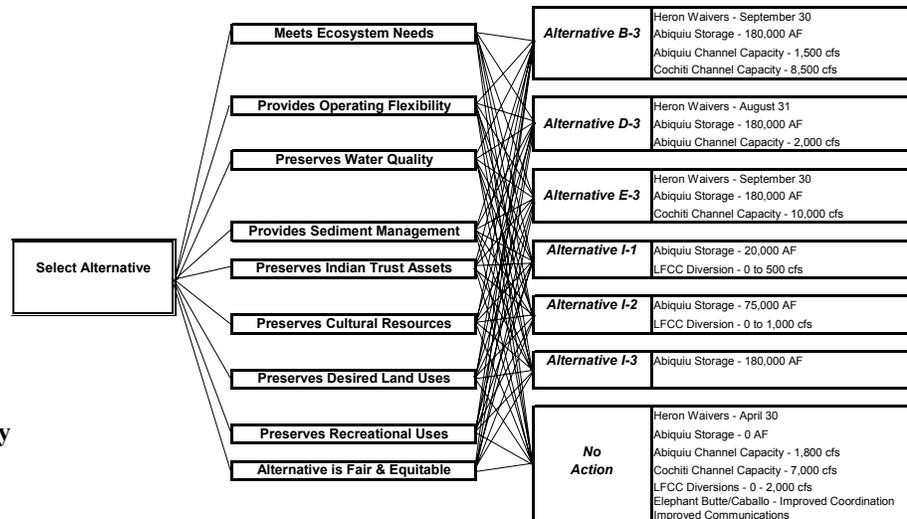


Figure 2. Decision Hierarchy

Alternatives were evaluated by the technical teams using performance measures appropriate for each resource and scored for maximum benefit. Where quantitative analysis was possible, if an alternative provided the maximum benefit, it received a score of 100 percent. Alternatives with lesser results received a score reflecting the percentage of the maximum resource benefit attainable. Where quantitative information was not available, qualitative scoring was performed using simple scales ranging from 1 to 10 and descriptors such as good, fair, or poor. The final ranking of the alternatives is displayed graphically and in order from highest to lowest in **Figure 3**.

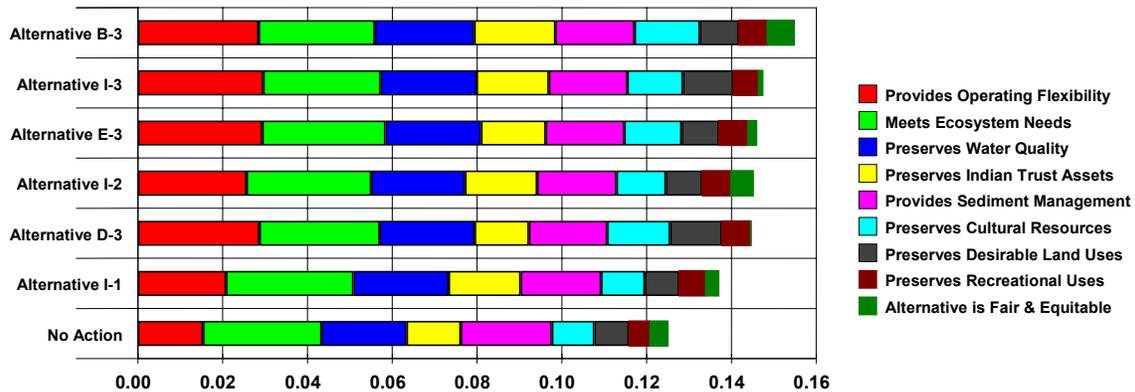


Figure 3. Final Weighted Ranking of Alternatives

SUMMARY AND CONCLUSIONS

The water operations review and EIS of the upper Rio Grande basin was performed by three joint lead agencies. The draft EIS addresses the environmental issues associated with, and analyzes the environmental consequences of, various alternatives for water operations plans. The alternatives addressed in the draft EIS are those that meet purpose and need for action and represent a broad range of the most reasonable alternatives. Alternatives were evaluated using appropriate performance measures for each resource and multi-criterion decision analysis was used for the ranking process. Analysis of the results indicated that Alternative B-3 is the preferred alternative, which provides for increased upstream storage and more efficient conveyance in the middle valley.

REFERENCES

U.S. Army Corps of Engineers, Bureau of Reclamation, and New Mexico Interstate Stream Commission (2006). "Upper Rio Grade Water Operation Review and Environmental Impact Statement" Volumes I&II, available at <http://www.spa.usace.army.mil/urgwops/drafteis.htm>.